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Mechanics

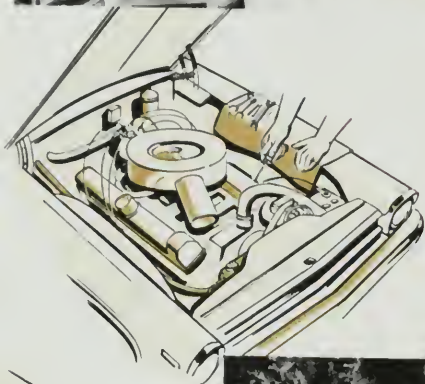
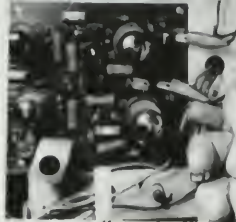
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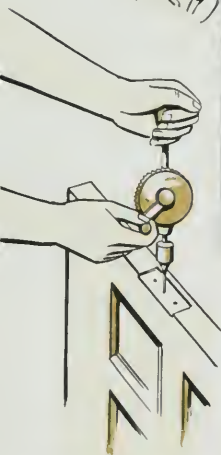
COFFEE MAKERS
DESKS

do-it-yourself

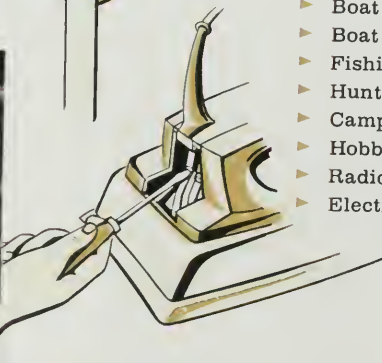
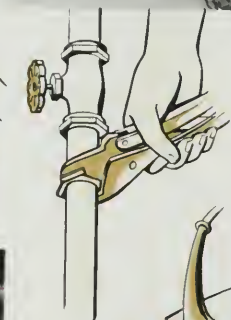
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Handyman
do-it-yourself
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do-it-



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A COMPILATION OF NEW AND PREVIOUSLY PUBLISHED SPECIAL
INTEREST PROJECTS AND MANUALS FOR THE
REPAIR AND CARE OF HOMES, AUTO,
APPLIANCES, HOBBY EQUIPMENT.
by the editors of

**Science &
Mechanics**

5

COFFEE MAKERS
DESKS

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➤ Basic features of coffee makers vary little from year to year. The major changes are in styling.



How to Repair Coffee Makers

Save money by making adjustments or replacing parts yourself for these relatively simple devices

THE QUALITY OF COFFEE is influenced by the coffee bean mix and condition, water quality and temperature, and the condition of the coffee pot.

The coffee pot must be clean and the water used must be between 175° and 195°F. at the time it passes over the coffee. Any lower temperature will produce coffee that is too weak and a higher temperature will extract more of the bitter oils from the coffee bean. If it is too cold it won't extract all of the flavor from the bean.

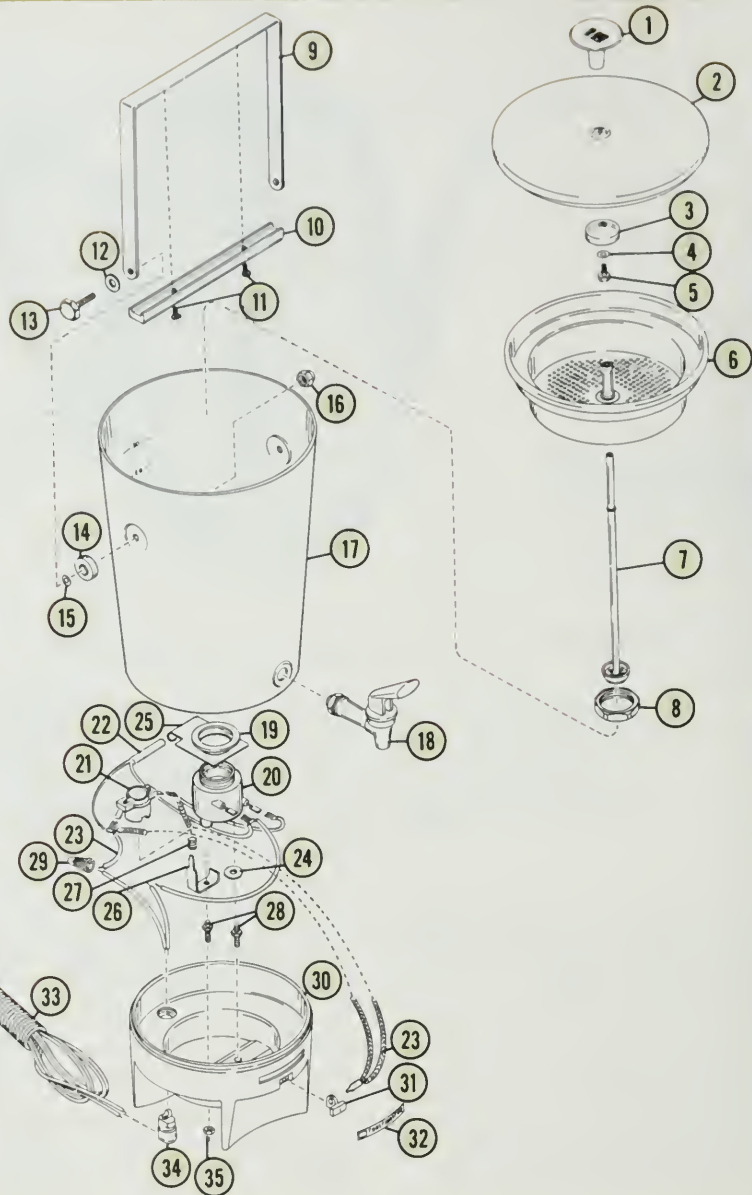
Bitter coffee results from using a pot

that has collected a layer of cooked-on deposits. This may come from the water used (lime in hard water areas), or coffee solids (containing some of the bitter oils). A regular schedule of "boiling out" the pot with baking soda will help to improve the flavor. (A strong vinegar solution can be used to dissolve the lime.)

Using hot water to fill a coffee percolator in order to save time will result in weak coffee because the "perking" time is shortened. The perking action results from steam generated at the bottom of the tube pushing water up the perk tube. The water then splashes over the grounds, percolating down through them to extract the flavor from the grounds.

In this coffee maker, steam is generated under the basket stem base in the pump heater well. Its flow is controlled by the pump check valve which is the *loose* disc

coffee table, contemporary: see furniture, indoor
coffee tables: see tables
coleus: see garden planning
colonial desk: see desks
colonial furniture: see early american



How to Repair Coffee Makers

◀ Shown is an exploded view of a typical percolator-type coffee maker. Use the following key to identify the numbered parts by name. ▼

REF. NO.	PART NAME	QTY.
1	Cover Knob	1
2	Cover	1
3	Deflector	1
4	Teflon Washer	1
5	Screw (Knob to Cover)	1
6	Basket and Guide Tube Assembly	1
7	Pump and Percolator Tube Assembly	1
8	Percolator Well Nut	1
9	Bail Assembly	1
10	Bail Handle	1
11	Screw (Bail Handle)	2
12	Bail Spring Washer	2
13	Bail Screw	2
14	Bail Spacer	2
15	Teflon Bail Seal Washer	2
16	Bail Nut	2
17	Body Assembly less Spigot	1
18	Faucet Assembly	1
19	Gasket for Percolator Well	1
20	Percolator Element with Casting Assembly	1
21	Disc Thermostat	1
22	Porcelain Insulator	1
23	Pilot Light, Keep Warm and Lead Wire Assembly	1
24	Asbestos Washer	1
25	Keep Warm Bracket	1
26	Hold Down Bracket	1
27	Hold Down Spring	1
28	Base Stud	2
29	Porcelain Connector Wire Nut	1
30	Base	1
31	Pilot Light Lens	1
32	T.M. Nameplate	1
33	Cord Assembly	1
34	Strain Relief	1
35	Nut Base	1

at the bottom of the stem. The clearance between the disc and its seat should be about .010-.015.

In operation the check valve allows water to flow through the holes in the stem base, past the disc into the pump heater well, then up inside the stem. When the water in the well gets hot enough to evaporate, this steam will expand, forcing the water out of the well. It can go two ways, up the tube or out the base through which it entered. As the water tries to escape through the entrance holes it lifts the check valve, thus closing these holes. The

only escape for the steam is through the stem—so up it goes, lifting the standing water in the stem with it. When the steam pressure in the well has been relieved, more water runs in and the cycle starts all over again.

The warmer the water gets the faster steam is generated and the faster the coffee perks.

It is important for all coffee percolators having a pump to keep the disc and valve seat clean, smooth and unscratched. Anything that will prevent the disc from seating properly will affect the coffee making.

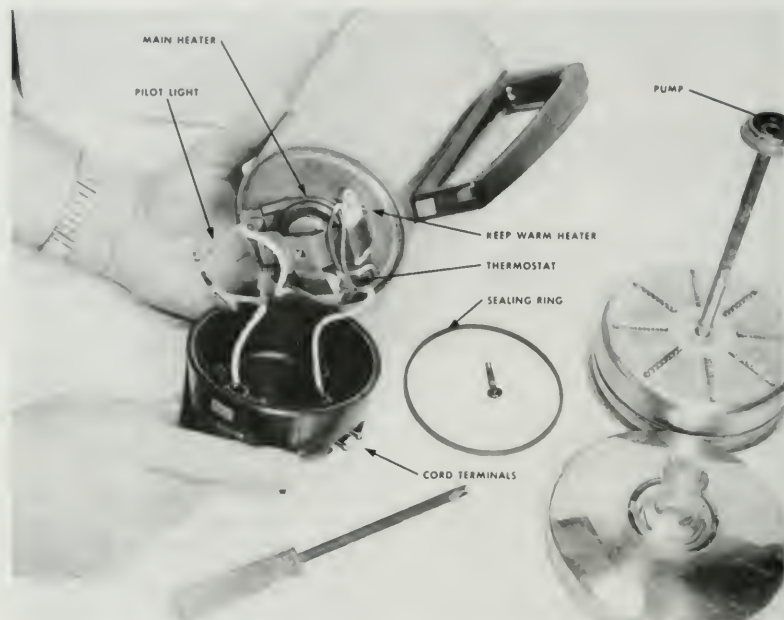
The heat to produce the steam comes from a thermostatically controlled heater element. All of this is available for test and service by removing the base.

There are two heater elements and a thermostat.

In operation, the thermostat remains closed to allow full line voltage to reach the main heater so it can boil water quickly. When the temperature reaches the pre-set range between 180° and 195° the thermostat opens to connect the “keep hot” heater holding the contents at the preset temperatures.

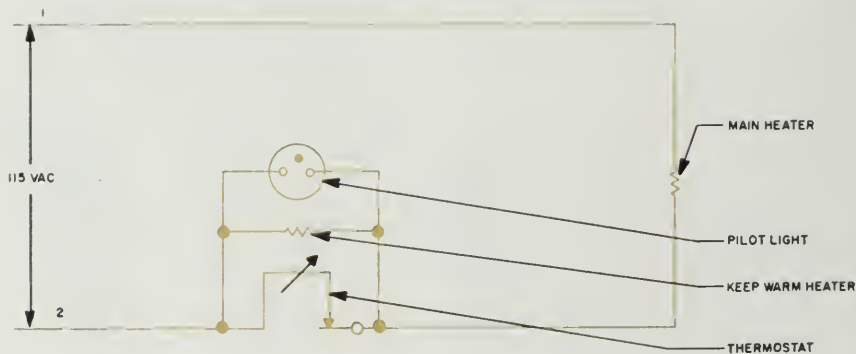
Do not attempt to adjust the thermostat if control of coffee quality and temperature can be had by changing the “mild” to “strong” setting.

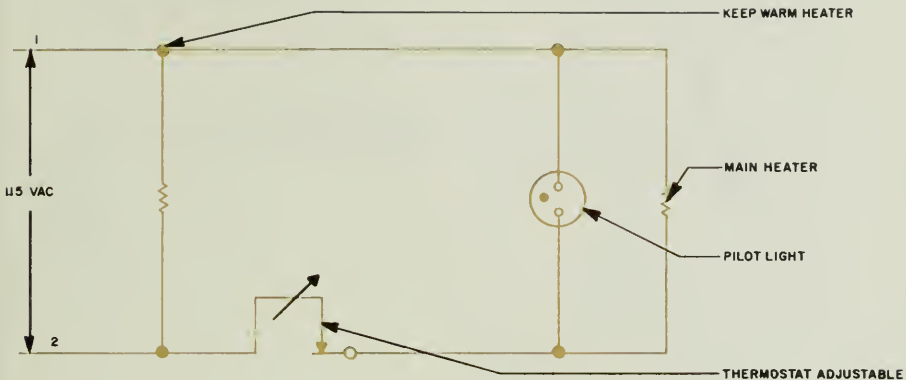
If you have to adjust the thermostat, set up the percolator with a thermometer immersed in the water, but *not touching the metal*. Use an AC ammeter or watt meter in the line circuit. During the percolating cycle, with the pump heater on, the wattage reading should be written $\pm 5\%$ of the wattage rating shown on the specification plate on the base of the coffee maker. During the “keep warm” cycle the wattage may be about 60 watts ± 10 watts. The temperature, when the “keep warm” element cuts into the circuit, should be between 180° and 195°F. when the control is set at the “strong” position.



▲ Wiring and controls of this submersible coffee maker are sealed in the base, when the base is attached. The thermostat in this design is not adjustable.

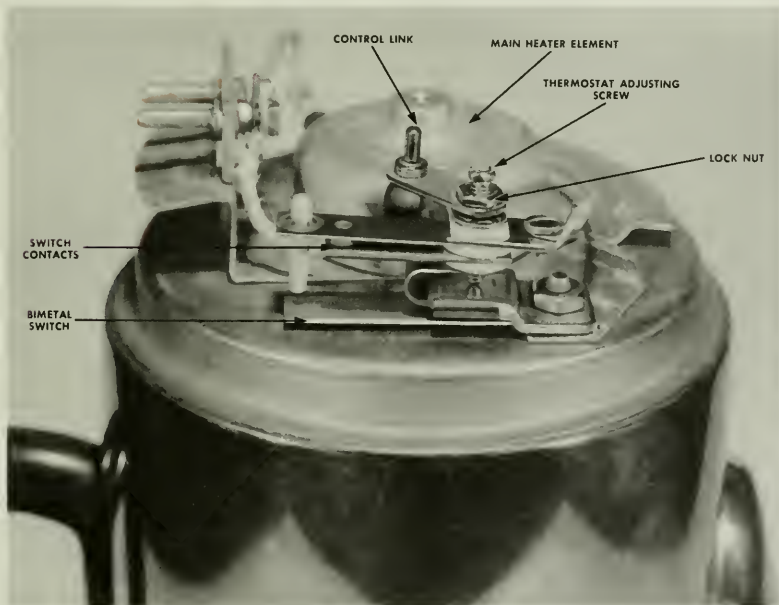
▼ Wiring diagram of a coffee maker in which the pilot light and keep warm heater come on when the thermostat opens.

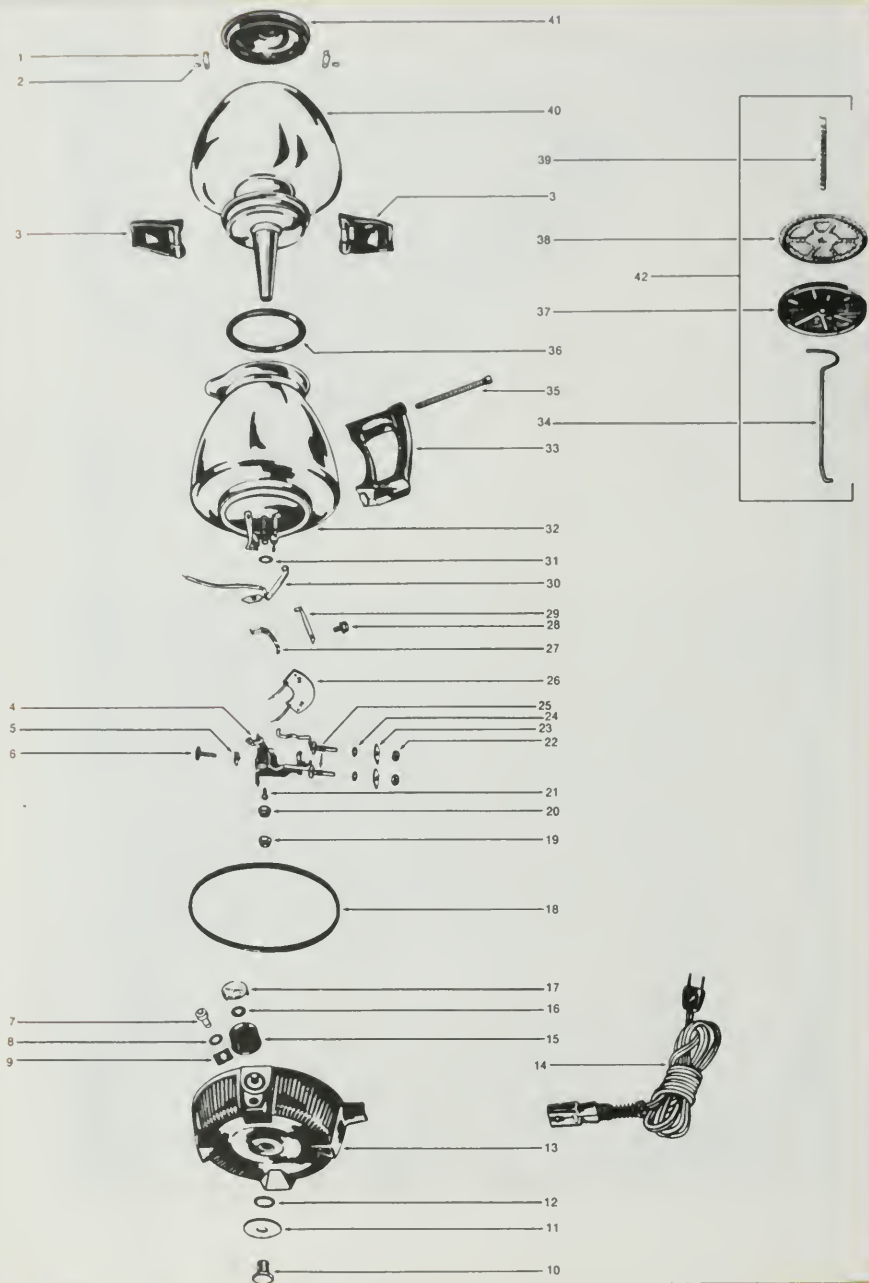


How to Repair Coffee Makers

▲ Wiring diagram of a coffee maker in which the keep warm heater is always on. The pilot light turns off with the main heater.

▼ Thermostat of this coffee maker is adjustable.





How to Repair Coffee Makers

◀ Main heating element is in lower bowl of a vacuum coffee maker. Use following key to identify numbered parts in exploded view. ▶

REF. NO.	PART NAME	QTY.
1	Button Spring	2
2	Cover Button	2
3	Upper Handle	2
4	Switch and Heater Assembly (Inc. Ref. Nos. 25, 26, 30)	1
5	Speed Nut	1
6	Adjusting Screw Assembly	1
7	Lens	1
8	"O" Ring	1
9	Spring Clip	1
10	Base Nut (Center Stud)	1
11	Spring Washer	1
12	Nut Seal	1
13	Base Assembly (Inc. Ref. Nos. 7, 8, 9, 15, 16)	1
14	Miniature Plug and Cord Assembly	1
15	Control Knob	1
16	Retaining Ring	1
17	Escutcheon	1
18	Base Gasket	1
19	Slop Nut	1
20	Switch Nut	1
21	Screw	1
22	Nut	2
23	Terminal Plate	2
24	"O" Ring (Terminal Stud)	2
25	Terminal Post	2
26	Secondary Heater Assembly	1
27	Lamp Bracket	1
28	Hex Washer Head Machine Screw	1
29	Thermostat Blade Assembly	1
30	Lamp Assembly	1
31	Sealing Washer	1
32	Lower Bowl and Element Assembly	1
33	Lower Handle	1
34	Filter Rod	1
35	Handle Screw	1
36	Sealing Ring	1
37	Filter Screen Assembly	1
38	Strainer Assembly	1
39	Filter Spring	1
40	Upper Vessel Assembly	1
41	Cover Assembly (Inc. Ref. Nos. 1 and 2)	1
42	Filter Complete (Inc. Ref. Nos. 34, 37, 38, 39)	1

Adjustment of the thermostat is made by unlocking the lock nut and turning the adjusting screw on the thermostat. After adjustment be sure to tighten the lock nut. Turning the screw clockwise lowers the temperature, counterclockwise raises it. A $\frac{1}{4}$ turn will change the temperature about 20°F .

If the thermostat has to be replaced, po-

sition the new one exactly as the old one was or else there may be interference with the base.

Replacement of the "keep warm" element is accomplished by loosening a screw at each end of the element, removing the old element and installing a new one.

The main heater element requires a large socket wrench for removal of the ring nut inside the bottom of the body assembly. When reassembling it, apply a silicone sealer on all the mating surfaces to prevent leakage. A silicone grease must be applied to the pump heater and ring nut threads to prevent them from corroding together.

Many electric coffee makers are *not* submersible, which means *don't* get the heater element, thermostat and wiring wet. If you do, you will get a nasty shock and possibly burn out the unit.

Some coffee makers are submersible. All the electrical parts and wiring are contained in a sealed base.

The screw holding the base to the body has a gasket under its head to prevent leakage around it. A gasket seals the base to the body. When removing the base be careful not to damage these gaskets. If there is any doubt about their condition replace them with new ones.

The thermostat for some coffee makers are *not* adjustable. They are designed to operate at a fixed temperature of about $195^{\circ} \pm 6^{\circ}\text{F}$. If the coffee gets hotter than this, make certain that the thermostat is making good contact to the bottom of the coffee pot. If it is and the coffee temperature is still not right, the thermostat will have to be changed.

The neon pilot light is connected in parallel with the main heater. This light is ON while the unit is perking and will go OFF when the coffee is ready to serve. The thermostat is connected in parallel with the warming heater element.

When reassembling the base make certain the base gasket is positioned correctly

in its groove and that the gasket around the screw is in good condition. Any leakage around the gasket or through a crack in the plastic will cause electrical leakage that can shock the user.

In a vacuum coffee maker, coffee grounds are placed in the upper bowl, which seals to the lower bowl containing water. Heat boils the water and steam pressure in the lower bowl forces the water up. When the lower bowl has cooled, steam pressure is reduced and the coffee flows down into it.

The "low heat" element keeps the coffee warm and the thermostat keeps the high heat element from reboiling the coffee.

In all electric coffee makers the thermostat is connected in series with the main heater element and is normally closed (making contact) at room temperature. Thus, there must always be a complete circuit from one contact of the cord plug to the other. Typically about 14-15 ohms for a 1,000 watt coffee maker.

If there is no continuity, disconnect the cord from the coffee maker and test from terminal to terminal. Continuity here would

How to Repair Coffee Makers

indicate a circuit defect in the coffee maker. The next sequence of testing would be to leave one test lead connected to one terminal and follow the wiring from the other terminal, testing at every connection. As long as there is no continuity, the defect lies between the probing test lead and the second terminal. When you do get a continuity reading you have just passed the defective part. That part will have to be replaced.

One final word of caution: After you have repaired a coffee maker, test for continuity and electrical leakage from each prong of the cord terminal block to the metal shell. If you have an ohmmeter the resistance from terminal to shell should be over 5,000,000 ohms when the unit is hot. It may be lower, down to 250,000 ohms, when the elements are cold.

The accompanying trouble-shooting chart should be used to determine the area in which to look for a problem. Often, careful looking will locate the problem and the method of repair will be self-evident—repair or replace.

See also: APPLIANCE REPAIR; ELECTRICITY.

PINPOINTING COFFEE MAKER PROBLEMS

PROBLEM

WEAK COFFEE
BITTER COFFEE
COFFEE REPERKS
DOES NOT OPERATE
DOES NOT KEEP WARM
GETS WARM BUT DOESN'T PERK

	INSUFFICIENT GROUNDS	STARTED WITH HOT WATER	INCORRECT CONTROL SETTING	STUCK PUMP VALVE	DIRTY COFFEE MAKER	DEFECTIVE THERMOSTAT	DEFECTIVE POWER CORD	DEFECTIVE PUMP HEATER	DEFECTIVE KEEP WARM HEATER
WEAK COFFEE	✓	✓	✓	✓					
BITTER COFFEE					✓	✓			
COFFEE REPERKS			✓			✓			
DOES NOT OPERATE				✓		✓	✓	✓	
DOES NOT KEEP WARM									✓
GETS WARM BUT DOESN'T PERK				✓		✓		✓	



How to Adjust Your Color TV

Straightening out garbled color means tuning your set for the spot where you watch it, and it takes more than turning the knobs in front.

Follow these step-by-step instructions to get the clearest possible color picture

ANYONE WHO HAS switched from black-and-white TV to color viewing makes a disturbing discovery. No longer do little picture distortions—out-of-round circles or misshapen figures—sink into the background. Color permits less of a compromise. Misadjustments may spring out at the viewer to clutter the picture with a spectrum of colorful smears, nightmarish tints

and ghoulish hues. We don't mean "fault"-type problems—outright failure of tubes, parts or antenna. These need servicing. Rather, it is the slow drifting that comes with time, or the intrusion of other factors which affect performance of an otherwise trouble-free set. The manufacturer anticipates such problems with a whole series of adjustments for correcting such error. Not just the user knobs on the front panel, but a complement of in-back controls that need an occasional touching up. They keep colors clean and the monochrome picture truly black and white.

Besides long-term drift, another significant force is at work. It is the stray magnetic field. So sensitive is the color receiver to magnetic forces that just moving the set around the room could deteriorate color, not to mention going from room to room or house to house. Even the earth's weak

columns: see hoppers

combination switches: see wall switches

combination tools: see hand tools



▲ *Fine-tune controls make for easy tuning on many modern color-TV's, but they can't correct poor adjustments.*

magnetic field has been singled out as a disruptive influence. Stray magnetism and inevitable drift, however, are readily corrected in the steps to follow.

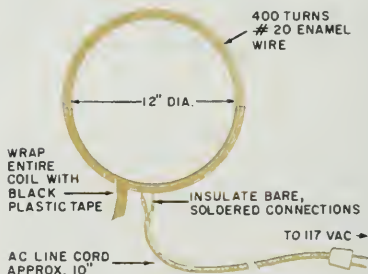
It's probably occurred to some viewers that symptoms of misadjustment may really be signs of deeper trouble. In many instances this is true. But until you've developed a sharp eye for these differences, there's the trusty trial-and-error approach to provide the answer; if routine adjustments to be described won't restore performance, chances are the circuits need servicing. Adjustments can be performed without major chassis removal, often requiring little more than removing the back cover.

How difficult? It follows the old law: the beginner flounders around at first, the experienced adjuster breezes through the job in mere minutes. So don't expect push-button precision at first. It takes a little time to get the feel and effect of the various

How to Adjust Your Color TV

controls. One thing in your favor: the set, though uncomfortable to view, may be just slightly out of adjustment. This means you can avoid time-consuming confusion by not moving any controls more than just a slight amount while observing the desired result. And don't despair over two factors peculiar to color TV: (1) you rarely set a control once and leave it there. Interaction is the rule, so be prepared for much repetition and (2) aiming for utter perfection is not only impossible but often a waste of time. Color TV is still a miracle despite traces of color error, especially at screen edges, or some color fringing around some objects in the black-and-white program. The adjuster tends to see the screen with a far more critical eye than when he sits five or more feet away as a program viewer.

Required equipment. Unlike the simpler black-and-white receiver, which usually can be adjusted by eye, the color set needs at least one test instrument. It's the color generator, a device which displays on the screen a pattern of dots, bars and other images which serve as a reference. Without such a unit, the adjustment job becomes hopelessly complex. (At least one kit manufacturer markets a suitable generator in kit form.) Clipped to the antenna terminals of the TV receiver, the generator "transmits" the desired pattern selected by a knob



▲ *For color TV receivers without automatic degaussing, a simple degaussing coil is needed.*

How to Adjust Your Color TV

on the front panel. Not only is the device needed for critical color adjustments but also serves for lining up certain black-and-white adjustments.

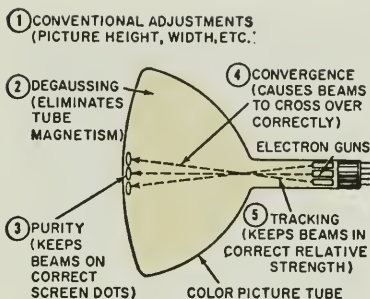
The next piece of equipment is the degaussing coil, the unit which demagnetizes stray pickup by the picture tube. Although such units are available, one may be inexpensively assembled by following the illustration. You'll need about four pounds of No. 20 enamel-covered ("magnet") wire. This is wound around some temporary form of 12-inch diameter for 400 turns. After removal from the form, the coil is held together by a wrapping of black plastic tape. A long AC cord (with plug) is attached to the two free ends of the coil.

A handy accessory during adjustments is a mirror. It's awkward, if not impossible, to get a good view of the entire screen while manipulating certain controls from the rear of the set. The mirror should be large enough to give a total view of the screen when placed in front of the set. A chair provides a good support of approximately correct height. (Two additional items, "cheater" cord and hex tool, are described later.)

Finally, the set's service manual should be on hand. Now that numerous TV makers have entered the color field, there are apt to be variations in location and set-up of controls from one set to the next. The step-by-step discussion to follow applies generally, but the manufacturer's special comments should also be checked.

Major steps. Adjusting the color set requires no grasp of complex theory, but a quick preview of major steps and why each is performed could prove helpful. The job begins with:

1. **Conventional Adjustment.** These are the familiar controls found on all TV receivers, monochrome or color. They include height, width, focus and linearity. Unless preset for proper performance, adjustments which control color will be seriously



▲ The five major steps for adjustment of color TV for optimum performance.



▲ All conventional controls—hold, width, linearity, etc., must be carefully adjusted first.

affected. Even setting of horizontal and vertical hold controls should be done with care. Misadjustment of horizontal hold can cause fanning out at the top of the picture, while a vertical hold set improperly may produce slanting retrace lines. (A suitable crosshatch pattern from the color generator

can serve as a guide for these initial picture adjustments.)

2. Degaussing. This is the demagnetizing step mentioned earlier. It cancels out magnetism picked up by the metal shell of the picture tube and surrounding parts. The operating principle of the degaussing coil is similar to that of an erase head in a tape recorder: by applying a rapidly changing magnetic field (provided by 60-cycle house current), the magnetized object is returned to a neutral state. (Degaussing will not be required for some receivers; it's done automatically by an internal circuit.)

3. Purity. If the color set cannot produce single, pure colors, it cannot be expected to properly render thousands of color mixtures required during a color program. This introduces purity—first major color adjustment. Done in two steps, it lines up three beams from the electron gun in the neck of the tube so they fall precisely on their respective screen color dots—red, blue and green. Actually, purity is

▼ *Degaussing rids picture tube and other parts of stray magnetism that affects color.*



How to Adjust Your Color TV

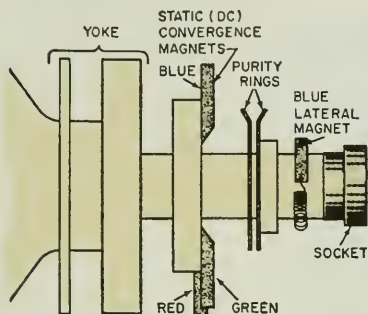
accomplished by using the red beam only. The other two colors will automatically fall into place.

4. Convergence. Not only do the three beams have to center properly on the screen, they must also come to a point just before reaching their corresponding screen dots. The beams are magnetically squeezed together (converged), and form a point just before striking the screen. Travelling a slight distance further, they cross over, fan out slightly, then strike their corresponding dots. To achieve this focusing effect for the entire screen surface, convergence is done in two steps. The first sharpens the image at screen center, the second corrects the problem of variable distance between guns and screen. (The beams must travel farther to hit the edges of the screen.)

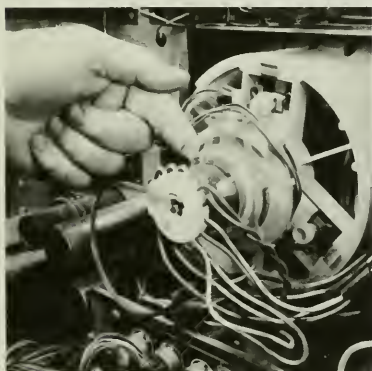
5. Tracking. Although the receiver is designed for color reception, its black-and-white performance is still critical. This final adjustment keeps color out of the monochrome image. Since the black-and-white picture is created by mixing red, blue and green in a fixed amount, any upset introduces undesired color tinting. Correct this by adjusting the beam strength of each electron gun for the proper gray shading.

Preliminary setup. Decide now where the set is to be located in the room for normal viewing—and leave it there throughout the whole course of adjustments. Some of your work will be undone if the cabinet is moved to a convenient area for better access, then returned to its permanent place. Plumbing pipes, air vents or other masses of metal unpredictably warp the surrounding magnetic fields which influence purity and convergence.

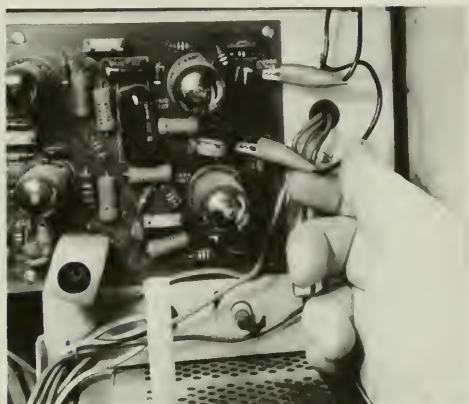
Room lighting is another factor which may be considered. Is the set to be viewed as daylight enters the room, or under artificial illumination? Photo fans will see the analogy; outdoor color film is balanced against the blueness of natural light, while the indoor film type takes into account the

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▲ Purity and static convergence adjustments are made on picture tube behind yoke.



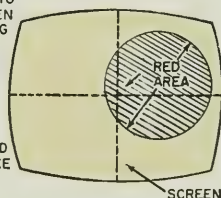
▲ The red area on the screen is moved to the center by using the tabs on the purity rings.



▲ Before making purity adjustments, disable blue, green guns by method that the set provides.

① BRING RED AREA TO CENTER OF SCREEN WITH PURITY-RING ADJUSTMENT

② FILL COMPLETE SCREEN WITH RED BY SHIFTING YOKE POSITION ON TUBE NECK



▲ The red area of the TV screen has to be centered and then expanded to fill the screen.

yellowish hues of artificial light. In adjusting the color set, these lighting factors affect the outcome. A set adjusted during the day for a good black-and-white picture, for example, can assume a hue of color under lamplight. Adjustments, if possible, should be made under normal viewing conditions. Since most viewing is ordinarily done in the evening, it's helpful to adjust at that time or draw the shades and exclude natural light.

Other preparations. Turn on both set and test generator in advance. Both units should be allowed about 20 minutes to warm up and stabilize at operating temperature. Also, the back cover of the set is removed. There is some variation in interlocks here, devices which automatically kill dangerous voltages when the cover is removed. This safeguard is designed to protect against accidental shock. During adjustments, however, the set must be fully

powered with the cover off. This usually requires the use of a special "cheater" cord to defeat the interlock. A suitable one for the particular set should be obtained, if necessary.

The matter of safety is even more critical for color than in the conventional black-and-white receiver. Voltages in color circuits run up to some 24,000 volts. While none of the adjustment points bear voltage, care should be exercised to avoid any accidental contact with nearby, exposed parts. There is no need to open the high-voltage cage or remove the cap plugged into the picture tube.

Some sets have removable top or side panels for access to certain internal controls. Others may have a springy wire which shorts the high voltage when the back cover is removed. These and other variations should be checked in the manufacturer's literature. Let's consider now, step-by-step, the various color adjustments. It's assumed that the conventional black-and-white settings (width, height, etc.) have been properly set.

Degaussing. (In this first step the receiver may be warming up, but it does not matter if the set is off during degaussing.) Degaussing is a simple procedure but one that requires careful technique. Don't be surprised if the coil warms up after plugging it into house current. It is designed solely to be powered for the short time required for the job. (Some sets may have "rim" or "field-neutralizing" magnets. If so, they must be retracted before turning on the degaussing coil.)

The coil is held with its flat side about an inch from the screen. Move it in circles over the whole area of the screen's faceplate and overlap into the bordering mask area to rid that region of possible magnetism. This part of the operation is done for about a minute. Now *slowly* back away with the coil, holding it in the same parallel position as before. When you've reached a

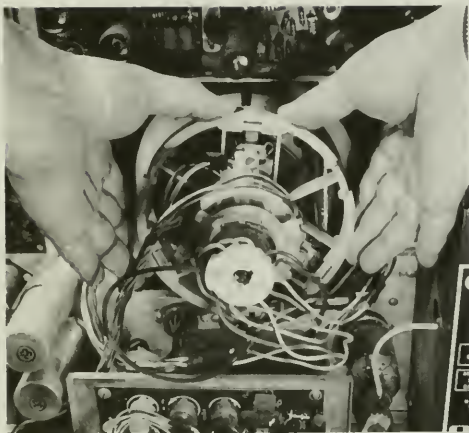
distance of about six feet, turn the coil at right angles to the screen (narrow side points toward set). Now it's safe to pull the plug out of the wall. Another precaution: don't use a plug that is loose in the wall socket. Any make-break in AC power during degaussing can remagnetize the tube.

Purity. This 2-step job begins by eliminating any possible source of interference on the screen, done simply by removing one of the receiver's I.F. tubes, or unplugging the I.F. cable running from tuner to chassis. (Don't forget to replace these after purity adjustments are completed.) Next is completely disabling blue and green electron guns in the picture tube. Only red will operate at this time. In the receiver illustrated, note that blue and green guns are deactivated by removing two clip leads from a terminal strip. For other sets, a small commercial adapter is plugged into the picture tube base. It has switches for disabling desired guns. (Such adaptors are often provided with the color dot-bar generator.) Some manufacturers specify clip leads for shortening out the guns.

Turn the set's contrast control fully off, brightness control to about halfway. The screen should now be essentially red. Locate the movable tabs on the purity rings and make the red color move to the *center* area of the screen. Some back-and-forth adjusting might be necessary. Not only should the red area predominate at the center, but its color should be as uniform as possible. Step 2 in the purity adjustment is sliding the yoke back and forth to cause the red area to fill the entire screen. (There's a screw clamp to loosen the yoke.) Note that the yoke does not nudge up against the bell-shape rear of the picture tube as in black-and-white sets. There is some play to permit purity adjustments.

The result of these steps should be uniform, uncontaminated red that slightly extends beyond (overseans) the borders of the picture tube mask. In some sets, rim

➤ Shifting the yoke along the tube axis causes a beam deflection that covers screen.

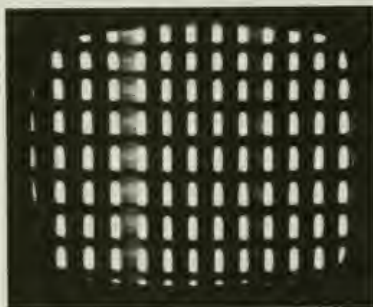


⚡ Color generator is tuned to frequency of an empty channel and set to generate dots.

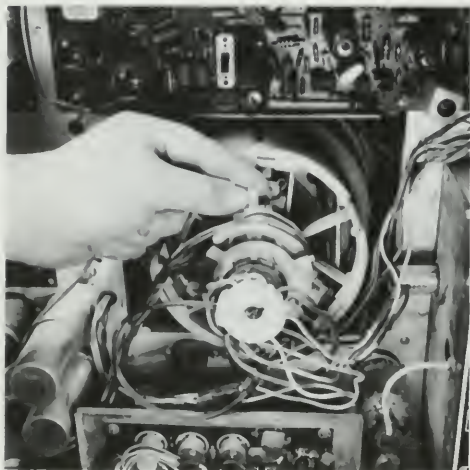
magnets around front the edges of the picture tube are adjusted for correcting color impurity existing out at the edges of the screen.

Convergence. For this step, the color generator is clipped to the antenna terminals in the set up illustrated. (Be sure the I.F. tube or plug removed earlier is back in place.)

The aim of convergence is a series of adjustments to produce pure white dots throughout the complete screen. Done in two major steps, static (or DC), and dynamic convergence, it should be possible to apply the right amount of correction.



⚡ Dot pattern is used during most color adjustments; it is also used for conventional ones.



▲ Static convergence magnets are located in holders clamped around neck of tube.

Begin with static convergence, done with three movable magnets, which can be slid in and out of their holders. During this step kill the blue gun, but keep red and green guns active. By careful operation of red and green magnets it should be possible to bring together close-spaced red and green dots on the screen. As they merge, they form a single yellow dot. It's especially important that these static-convergence adjustments be made while viewing dots only at the *center* area of the screen. Now activate the blue gun. Its magnet is slid to cause the blue dot to overlap the yellow dot. An additional control—the blue lateral magnet clipped on the tube neck near the base—permits side motion of the blue dot. As in other adjustments, static convergence requires some juggling back and forth among controls to achieve satisfactory results. The end product should be pure white dots in the central screen area.

Controls for dynamic convergence, which bring together dots lying outside

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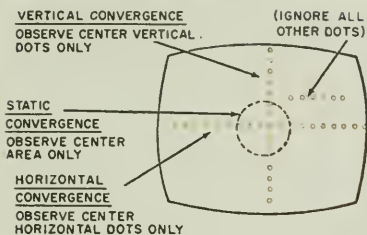
screen center, are generally mounted on a separate "convergence board." In many instances long cables to the board permit it to be mounted conveniently on the bottom front edge of the cabinet. Note how it is temporarily fastened in place by two screws. Thus, controls are accessible while the screen is viewed directly.

The various controls are divided into two major screen areas; horizontal and vertical. With the color generator producing the same dot pattern used earlier, begin with vertical convergence, the six knobs on the board's left side. During these adjustments, it is important to view only the *middle vertical* row of dots. All others are ignored. Red-green controls can be adjusted first, and the blue gun turned off at this time. While watching the vertical column of dots, carefully turn Red Tilt, Red Amp, then Green Tilt and Green Amp in an effort to merge red and green dots so they form single yellow dots. Following this, the blue gun is restored and Blue Tilt and Blue Amp adjusted so the blue dot overlaps the yellow dot for the desired result; a pure white dot, more specifically, a complete vertical row of white dots.

This process is apt to be confounding at first due to interaction—turning of one control upsets the setting of another. And, in fact, when upper and lower dots appear to be perfect, *center* dots in the vertical row go out of whack. This is to be expected. The remedy is to go back and touch up the magnets used earlier for static convergence to re-align the center.

There's another approach to dynamic convergence which might prove helpful until more experience is gained. This is to leave the blue gun on, then adjust red and green controls to bring those dots into line with blue (which serves as a reference). Also some technicians prefer not to use the dot patterns at all for convergence. They switch the generator for a crosshatch pattern. Here, only the vertical column or line

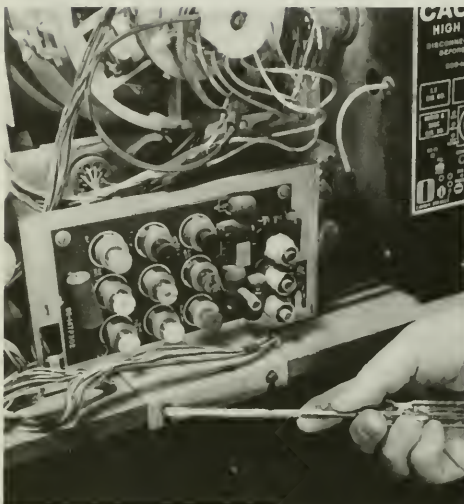
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▲ In static convergence adjustments, observe only dot pattern in center area of screen.

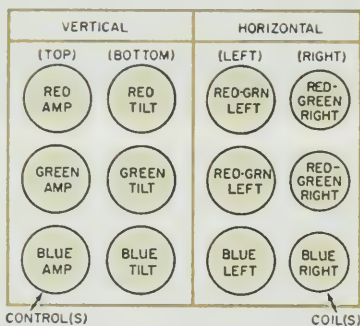
➤ For convenience, remove the dynamic convergence control board from its mounting inside the cabinet.

▼ When "board" is secured to bottom front edge of set, it can be adjusted while viewing screen.

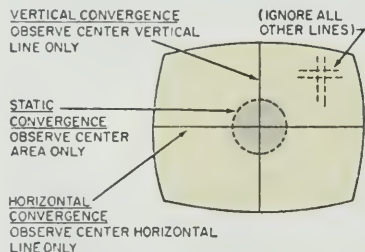


at the center of the TV screen is viewed for vertical convergence adjustments.

Horizontal convergence is next, a procedure not unlike the one above, only now the *middle horizontal* row of dots (or lines for crosshatch) comes under adjustment. There is a difference; red and green *overlap together* on each of the two left and right controls. Thus, the red and green color dots will move at the same time. Blue, as shown, has its own individual controls. Also, the extreme right-hand controls are not usually provided with knobs, but require the insertion of a plastic hex-type aligning tool. After turning off the blue gun, the various



▲ The dynamic convergence board layout conveniently groups horizontal and vertical controls into logical position and color pattern.



▲ Color generator can be set to give a cross-hatch pattern for convergence adjustments rather than the dot patterns discussed.

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red-green controls are used to produce single yellow dots on *right* and *left* halves of the screen over the entire middle horizontal row. When yellow dots are visible, activate the blue gun and adjust the two blue controls. As blue overlaps yellow the desired white dots should appear. Those blue controls only move the blue dots up and down. For side to side motion, it is necessary to return to the blue lateral magnet mentioned earlier. Again, static convergence (on screen center) may be affected by dynamic convergence, so some back-and-forth adjusting might be in order. It's a good idea, too, to make a final check of color purity, described in the preceding section.

Tracking. After purity and convergence are completed, output of red, blue and green electron guns is adjusted. This assures that a correct proportion of primary colors will be delivered for creating the black-and-white picture. The controls are usually at the rear.

Although tracking controls may differ in number and marking, the general idea is as follows: first tune to an unused channel and turn the set's contrast and front-panel color controls to minimum. This should fill the screen with white light (or raster). With the brightness control turned up (though not to maximum) adjust red, green and blue screen controls for best, color-free white light. If, for example, blue is apparent, back off slightly on that control.

This completes the job. How well does a color TV stay in adjustment? There is no set period, but you can expect that, with normal conditions, convergence remains fixed for fairly long periods, say upwards of two years or more. Any jostling, magnetizing or moving of the set especially affects color purity. But knowing when to repeat the job is the easiest step of all. During day-to-day viewing, your eye will make that decision.

L.B.

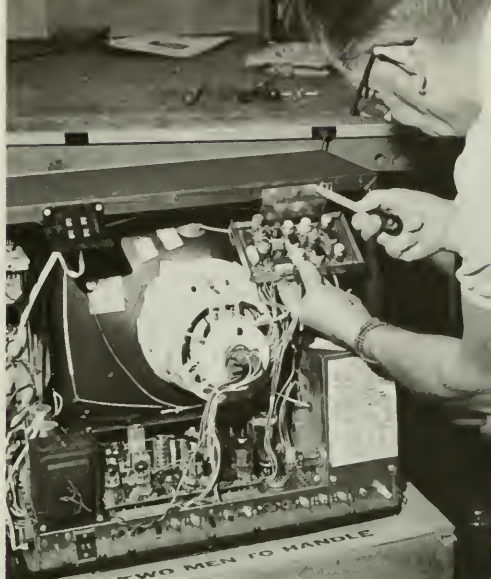
See also: ANTENNAS; ELECTRONICS.

How to Change a Color TV Tube

You can cut costs by doing this job yourself, even if you have to call in a serviceman to make some of the adjustments

WHEN YOUR COLOR PICTURE TUBE becomes dim and one or two colors are very weak, you can replace that color tube yourself. Follow the photos and text in this article and you can save yourself some money. This article shows how to replace the round and rectangular color picture tubes. The sizes are 21-inch round, 25-, 23-, and the 19-inch rectangular color CRTs.

The initial preparation consists of taking the TV chassis from the cabinet. First, remove all knobs and the rear cabinet cover from the TV receiver. Discharge the high-voltage charge of the tube with a long, insulated-handle screwdriver—from anode connection to the TV chassis. Be real careful, and do a good job of grounding out the high-voltage cable. In older TV receivers, the high-voltage cable must be unfastened from the metal box before you open the lid of the box. This lead will pull out of a pin socket. In newer TV sets, the high-voltage lead unplugs from the glass picture tube. Unbolt the TV chassis and unplug all wires going to the TV chassis.

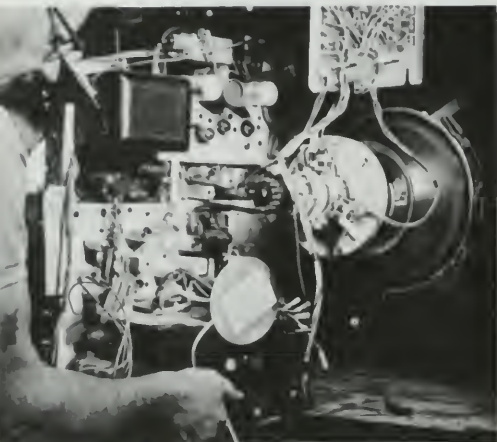


This includes the picture tube cap or socket, yoke leads, and speaker leads. All the colored wires going to the deflection yoke are marked on the yoke where they are plugged in. There is little danger of getting them wrong when replacing them. Unhook the blue grounding lead from the blue lateral magnet. Unplug the convergence yoke cable from the TV chassis and also loosen the antenna terminal assembly.

Before pulling out the chassis, be sure all cables and wires are disconnected. On the older models, pull out the chassis three or four inches and loosen the $\frac{1}{4}$ -inch metal screw, holding down the small-controls assembly. Slide the assembly back and pull up. Now the chassis is free.

The tube comes out. The cabinet should be turned over on its face before removing the color tube. Be sure to lay a blanket or thick padding upon the floor to keep the cabinet in ship shape. Have someone help place the TV cabinet front down upon the padding.

In the older color sets the dynamic convergence magnet assembly slides separately



▲ *Don't be afraid to make notes about various connections as you disconnect chassis from CRT and yoke. It can save you hunting later.*

off the neck of the tube. In the rectangular 25-inch sets the yoke assembly also contains the convergence coils and fits tightly against the cover tube.

Four nuts hold the picture tube in place—two at the top and two at the bottom. A metal flange surrounds most tubes, near the face of the tube. In the later model color sets, the automatic degaussing coils (ADG) are fastened to this framework. In the 25-inch sets the metal flange must be removed before you can get to the nuts holding the color tube in place.

Now remove the components from the neck of the color picture tube. In case you are not familiar with the location of these components, measure their position on the neck of the color picture tube. This procedure is quite helpful when replacing these components to the neck of the new color tube. *As a safety precaution, wear safety glasses when working close to the picture tube. Do not put pressure on neck of CRT or let tube rest on neck.*

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Clear the neck. Place the kinescope face down on a drop cloth or newspaper to protect the face from scratches. Now remove the components from the neck of the tube. When you remove the blue lateral magnet, you will notice that it sets over a tab or clip inside the tube neck.

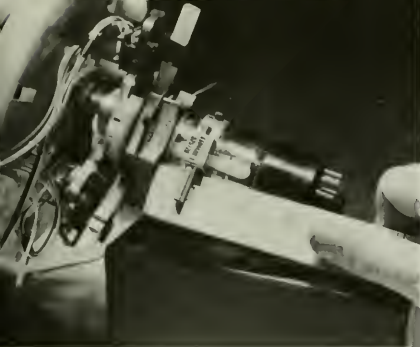
In the older sets, the purity ring sets over the red ring marked inside the tube. Note that the blue wires from the convergence assembly go to the top of the picture tube over the blue gun, the red wires at the left side, and the green wires on the right going to the green dynamic convergence coils.

The large deflection yoke is loosened with a 1/4-inch nutdriver and can be lifted off the neck of the tube. It is very heavy; do not drop it! Be especially careful not to rap the CRT with a tool or heavy object. *The CRT must be handled with care since it can implode and cause serious damage to you and the set.*

The masking must be removed from the

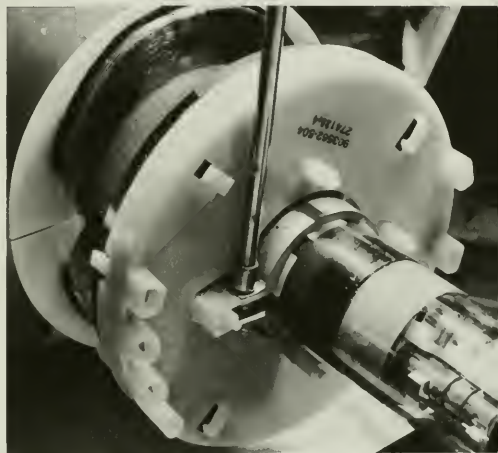


▲ *Place cabinet face down on folded blanket to protect picture tube and finish.*



⚡ *Be sure to mark down measurements so you can replace the yoke assembly.*

⚡ *After yoke assembly has been loosened with nutdriver it can be removed. Assembly is quite heavy—don't drop it.*



front edge of the CRT. On the rectangular tubes, a strap with corner flanges must be removed by loosening a side-bracket bolt. Remove the bracket (i.e., masking) assembly from the old CRT and place it upon the new tube.

Be sure the CRT is lying in the same position as mounted in the TV cabinet. Now put the strap in place on the new CRT and tighten up the bracket assembly. Be sure the high-voltage (anode) button is at the top of the set on a 25-inch picture tube. The 23-inch and 21-inch round-CRT anode connections are on the side of the tube.

Reassembly. Place all components back on the neck of the CRT. Use the previously taken measurement for their approximate position. In the older sets the yoke must be mounted so it will slide back and forth for purity checks. The 25-inch yoke assembly fits snugly against the bell of the tube. This yoke slides back and forward inside of the large yoke assembly. Two small screws are loosened on each side of the plastic yoke assembly.

Tubes that are not bonded have a safety glass—be sure the glass is clean. Wash it with soap and then rinse with clear water. Make sure there is no lint or dirt on the face of the new CRT. Seat the tube in its place in the cabinet and bolt it to the front brackets. Replace the metal shield and degaussing-coil assembly, if the set has one.

Now set the cabinet upright and fasten the convergence board in place. Install the

TV chassis and connect all cables. Make certain that all parts are replaced and tightened. Banging against metal parts will sometimes induce magnetism into these parts and a second job of degaussing may be required. Be sure that all cables are connected and in place. Turn on the color receiver and leave it on for 15 to 20 minutes before purity or convergence checks are made.

Basic adjustments. Color-TV convergence can take time and may require skill. You may want to degauss and converge the color TV yourself, if correct equipment is available. If not, get help from a good reliable color-TV serviceman and pay him to finish the job.

If you want to do it yourself; here goes: Position a degaussing coil near the picture

tube to completely neutralize any induced magnetism. This step will help insure proper purity and convergence when the picture tube is converged. Hook up the dot-bar color generator and let it warm up as the color-TV set warms up. When replacing the CRT, even sets with built-in degaussing coils should be degaussed just as if one were not built into the TV cabinet.

Take a quick look at the TV screen and if there are any color shaded areas the set should be put through a purity check up.

To start the purity adjustment turn off the set and unplug the IF cable going to the tuner. Plug the AC-interlock cord back in, let the receiver warm up, and short out the green and blue grids through a 100K resistor. (There are commercial kinescope grid-

How to Change a Color TV Tube

shorting switch boxes on the market for just this purpose.) At the moment the screen should be red. Adjust the center purity ring for a center red coloring. Then push the yoke back and forth and adjust the purity ring until the entire screen has an even red tint. The red-, blue-, and green-grid connections are generally on the top of the chassis. These three colored wires go to the picture tube socket.

If the purity adjustments are done correctly, the green and blue shading will fall in line. It is always best to check each one separately by shorting the other two grids to ground through a 100K resistor. If a little shading persists, try degaussing the CRT again and start over with the red adjustment procedure again.

At this time, check the level of the picture and see if the picture is in focus. Sometimes it is difficult to do a good job of convergence with the set out of focus. When you reset the focus control, convergence dots are way off.

Getting a picture. Convergence is relatively easy on the new color receivers. The older models require patience and plenty of time. Connect the dot-bar generator to the antenna terminals. Remove the conver-



▲ Make careful note of how the front protective mask is removed from CRT to make replacement much easier. Plastic mask on 21-inch CRT must be placed evenly before taping in place. Tighten up the bracket assembly.►



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◀ High-voltage connector is at top of 25-inch CRT's—on side of 19- and 23-inch CRT's. Make sure! Resistor, with spring, bridges anode buttons. You can now begin reassembly. ▼



gence board from the back of the set and place it on the slots at the top and back of the set. Tighten the two metal screws so the board is solidly in place. Watch the wires that connect the board to the yoke assembly so that they do not get tangled.

If the receiver was in convergence when the color CRT went bad, the dynamic convergence controls will generally need only a touch up. Set the generator to get *dots* on the CRT screen and check the dots down through the center of the screen. Short out the blue gun with the 100K resistor. Bring the red and green dots together on a center dot. Slide the red and green magnets in on top of one another. Readjust the setting, if needed.

If they won't quite come together, remove and rotate the red magnet a half turn and reinsert it, and adjust again. Now, once the red and green dots are centered, short the green grid and line up the red and blue dots. (The blue-beam magnet moves the blue dot up and down. The blue lateral-beam moves the blue dot horizontally. Place them on top of one another). Go back and check the red and green guns once again. Check that all three dots are together. You should now have a white dot.

The amplitude and tilt controls should not be adjusted unless the dots fail to converge.

Now, step back and take a look at the screen from a distance. Tune in a black-and-white program from a local station and check for color fringing. Generally, the convergence board does not need to be adjusted unless tampered with.

If the dots do not converge at the ends, top, and bottom, the vertical and horizontal adjustments must be made. Use the manufacturer's convergence and adjustment information and follow their alignment procedure. It is best to go over color convergence several times and then get away from the dots. Go back in a few minutes and recheck.

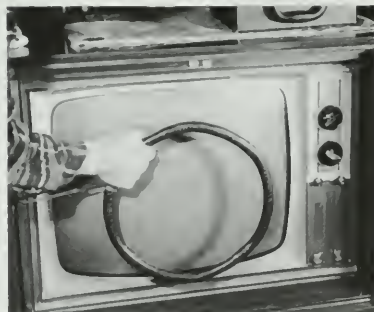
Follow the factory adjustment for black-



▲ When replacing CRT's that are not bonded, safety glass must be cleaned of fingerprints and lint. Double check mask to make sure it is aligned properly in set.



▲ When convergence board has been reinstalled and all nuts and machine screws have been tightened, the chassis can be returned to the cabinet and secured too.

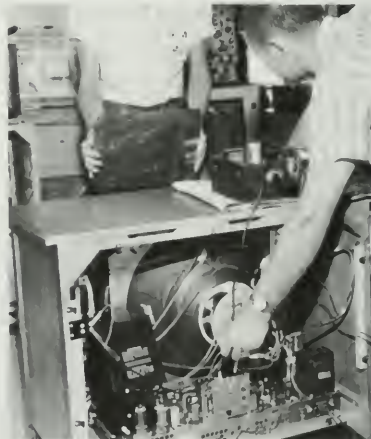


▲ Degauss the CRT even if there is a built-in degaussing coil.

and-white setup. The newer TV color receivers have a *service-normal* switch mounted at the rear of the chassis. When this control is thrown to the *service* position the raster collapses into a thin white line. You adjust the three screen controls until the vertical line is perfectly white. Now flip the switch to *normal* and the picture is black and white.

H.L.D.

See also: ELECTRONICS.



▲ The last step is the most crucial of all the steps in the replacement of a color CRT. Color purity has a lot to do with the overall enjoyment you get when watching your favorite programs. None can thrill to faces that are tinged with green, or grass that has a purplish tinge. If you don't have the necessary equipment you can have your local TV service technician do both the color purity and convergence adjustments. Fee is less than paying for a complete job.

Communicating with Light Waves

**How to build equipment to
send and receive messages
by invisible infrared light**



ALL IT TAKES is a handful of components for you to assemble your own invisible light communicator. Your unit will operate in the infrared portion of the electronic spectrum to transmit voice up to nearly a thousand feet.

Unlike radio, optical communications make use of relatively narrow beams of light, and because the wavelength of light is so high, engineers have shown how a tremendous amount of data can be packed on a single beam. Since the beam can be invisible—as with the infrared system used in the communicator described here—transmission is private and nearly undetectable.

The revived interest in optical communications shown recently is the result of significant progress in the field of electro-optics. Several types of lasers show great promise for optical communication applications, but the ordinary light emitting diode (LED) is currently one of the most practical con-

tenders. The LED, usually made of gallium arsenide, is a semiconductor which emits infrared light when forward biased. It was invented more than ten years ago, but only recently has the price of commercial units dropped to the point where they can be purchased by experimenters.

How it works. The communicators consist of two self-contained units, one a transmitter and the other a receiver. The units are assembled in a plastic lantern light case, but any convenient enclosure will do. In fact, both a transmitter and receiver can be assembled in the same enclosure to fabricate a transceiver.

The LED is modulated by means of a preassembled miniature transistor amplifier. It is connected to the amplifier's output transformer through a single transistor coupling stage. Two penlight cells provide the LED's driving voltage. Excessive current can degrade or damage a LED, so



▲ Low-cost lantern cases filled with transmitter and receiver parts form light communications system. Visible are solar cells in receiver (left) and collimating lens of transmitter (right). Two-way communication requires two sets of two units each.

current limiting is provided by a 100-ohm resistor (R2).

An amplifier similar to the one used in the transmitter is used in the receiver. But a pair of silicon solar cells are connected to the amplifier's input and serve to convert the optical signal to a corresponding audio signal. The amplifiers are available from most mail order electronics distributors, but usable amplifiers can often be salvaged from discarded portable transistorized tape recorders or players.

Transmitter construction. Begin construction of the transmitter by drilling three $\frac{1}{32}$ -inch holes in an open space on the output end of the amplifier board. Insert transistor Q1 into the holes and solder its base and emitter leads to the appropriate terminals on the printed circuit board. If necessary, use short lengths of insulated tubing to prevent Q1's leads from shorting against other wiring. Q1 can be practically any general purpose PNP transistor. (Note: the amplifiers used here have a positive ground. If an amplifier with a negative ground is used, Q1 can be any general purpose NPN transistor. See the

Communicating with Light Waves

circuit diagram for additional information.) Q1's collector lead should be left unconnected in preparation for the next step.

Next, cut a 2 x $\frac{3}{4}$ -inch rectangle of perforated board and mount two fahnestock clips on it with appropriate hardware. The board's purpose is to permit you to mount the LED in a position where its light is unobstructed and to mount one or two other components. Drill a $\frac{1}{8}$ -inch hole in the output end of the amplifier board and mount the perforated board to the amplifier with an aluminum bracket. Place the bracket so that it doesn't short against any of the amplifier's printed wiring. Insert a 100-ohm resistor in the perforated board below the clips and solder it in place according to the circuit diagram. Where necessary, use lengths of hookup wiring to reach distant portions of the circuit. Also, solder Q1's collector lead to the appropriate terminal of the LED clips.

Screwdriver drift. The 10K gain control potentiometer can be mounted on the inside of the plastic case, or, since adjustment is infrequent, to the perforated board. The latter approach was used in the prototype; a $\frac{1}{4}$ -inch hole drilled into the back of the flashlight case permits the pot to be adjusted with a screwdriver. If the pot is mounted to the perforated board, be sure to drill an appropriately spaced and sized hole in the board before mounting it to the amplifier.

Before mounting the amplifier-LED assembly in the enclosure, install the battery holders. Use AA penlight cell holders for both the penlight cells and the nine volt battery. The latter holder should be modified by sawing the terminal end off and using a standard clip connector to make contact with the battery connectors.

When the battery holders are installed, mount the amplifier-LED assembly inside the enclosure. First, insert the LED into the clips and carefully orient it so that it will face toward the portion of the encl-

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sure where a collimating lens will be installed.

Get it focused. The amplifier board is mounted to the enclosure with 4-40 hardware. Cut a pair of slits in the bottom of the enclosure so the focus of the LED can be varied by simply moving the entire amplifier-LED assembly in the case. Also at this point, connect leads to the circuitry for the microphone jack and switch. Be sure

to leave battery holder, microphone jack, and switch leads long enough to permit the amplifier-LED assembly to be removed for servicing.

A plastic lens was used with a focal length of about $4\frac{1}{2}$ inches to collimate the infrared light from the LED into a narrow beam. Actually, almost any convex lens can be used to focus the light beam; just be sure the focal length is several inches and the lens diameter is sufficient to intercept the entire beam from the LED. Most department stores carry a variety of inexpensive magnifiers which can provide an appropriate lens.

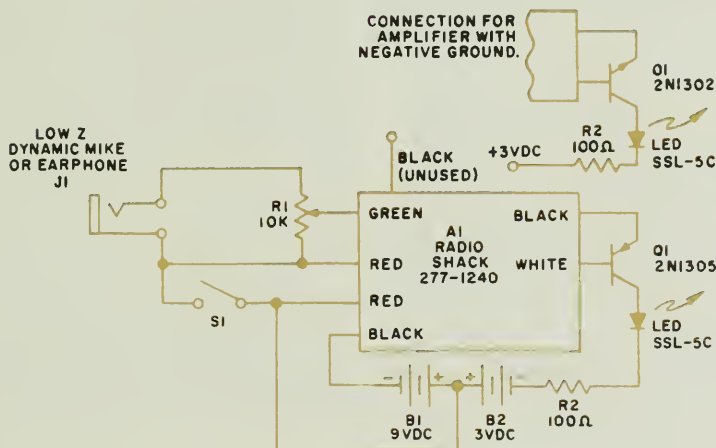
The plastic dust cover which protects the flashlight's parabolic reflector is used to mount the lens. Since it is not required, remove the reflector and set it aside for use in another project. Cut a hole in the clear plastic dust cover for the lens; if the plastic lens mentioned in the parts list is used, the hole should be 2 inches in diameter. A plastic shoulder on this lens permits easy mounting. Insert the lens and glue its edges to the dust cover.

Receiver construction. Assembly of the receiver is similar to that of the transmitter.

PARTS LISTS—Transmitter

A1	100mW audio amp. (Radio Shack 277-1240 or equivalent)
B1	9-volt transistor radio battery
B2	3 volts (two AA penlight cells)
J1	Microphone jack
LED	SSL-5C light emitting diode
Q1	Transistor, 2N1305, HEP-629
R1	10,000-ohm potentiometer
R2	100-ohm, $\frac{1}{4}$ -watt resistor
S1	Push button switch, normally open

A partial kit consisting of LED, Q1, J1, R1, R2, low impedance earphone (for use as microphone) lens, battery holders and receiver parts is available from MITS, Inc., 2016 San Mateo SE, Albuquerque, N. M. 87110. LED is available from General Electric Co., Miniature Lamp Dept., Cleveland, Ohio 44112.



The amplifier board can be mounted in a fixed position, however, and there is no need for an additional circuit board. Mount the battery holder and volume control on the inside of the case. A speaker was included on this unit (along with an earphone jack), but it can be eliminated in favor of an earphone if desired.

The infrared light from the transmitter is detected by a pair of back-to-back solar cells in the receiver. The cells, which must be the silicon type, are mounted in the receiver's parabolic reflector by their wire leads. Mount the cells back-to-back by very carefully soldering a small wire from the positive terminal (along the front side of one cell) to the negative terminal, which covers the entire back surface of the other cell. Silicon solar cells can be purchased economically in kits that include silicon, cadmium and selenium cells. Or, International Rectifier type SIM cells can be used if the case is opened and the wafer of cells inside is removed.

The remaining positive and negative leads are used to hold the two cells in position; feed them through the reflector's aperture, and wrap them around the protruding neck. A small plug is soldered to the

Communicating with Light Waves

leads, and a jack is soldered to the amplifier input so that the detector-reflector assembly can be quickly disassembled if necessary.

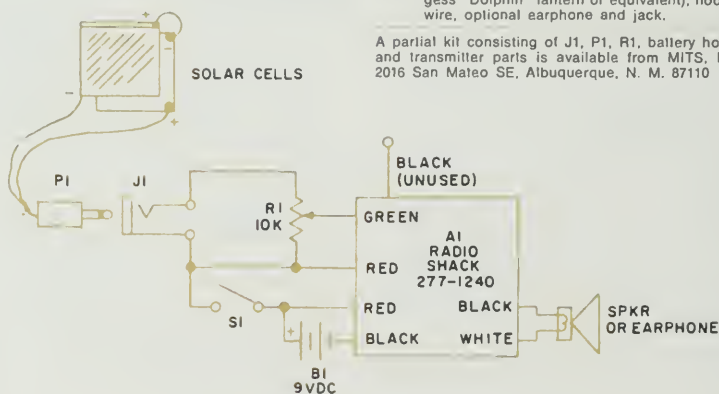
Note. When soldering to the solar cells, use a 30-watt soldering pencil. Do not use a soldering gun. With reasonable care, the experimenter with average soldering ability should have no trouble soldering the leads to the cells. If it is preferred not to solder to the cells, make use of the wire leads already soldered to the cells. Also, it is not absolutely necessary to use two cells since the cells are mounted in a reflector to capture a fairly large quantity of signal. It is more efficient to use two of them, but just one cell may be used.

PARTS LIST—Receiver

A1	110mW audio amp (Radio Shack 277-1240 or equivalent)
B1	9-volt transistor radio battery
J1	Miniature Jack
P1	Matching plug for above
R1	10,000-ohm potentiometer
S1	Push button switch, normally open
SO1	Silicon solar cells, unmounted (see text)
SPKR	8-16 ohm speaker

Misc. Hardware, battery holder, flashlight case (Burgess "Dolphin" lantern or equivalent), hookup wire, optional earphone and jack.

A partial kit consisting of J1, P1, R1, battery holder and transmitter parts is available from MITS, Inc., 2016 San Mateo SE, Albuquerque, N. M. 87110



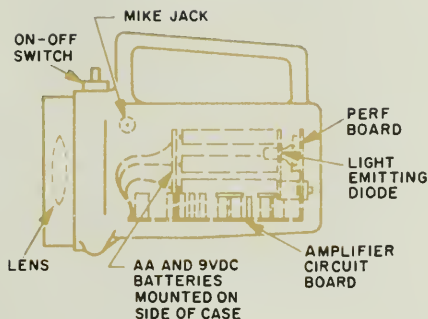
Communicating with Light Waves

Getting on the air. When the receiver is assembled, insert a nine volt battery in its holder, clip on the terminal snaps, and place the detector-reflector assembly back on the unit. With the reflector pointed toward a standard room lamp (incandescent or fluorescent) a 60 Hz tone should be heard from the speaker or earphone. If the tone is heard, the receiver is operating properly and the transmitter can be checked out. If not, carefully check the circuit for wiring errors. Also, make sure the battery is fresh.

To check the transmitter for proper operation, insert the batteries, turn the unit on, and point it at the receiver. Speak into the microphone and listen for the received signal in the receiver. If the signal is heard and the voice is reasonably good audio quality, the units are both operational and ready for field testing. If the voice is not heard or is of poor quality, turn the transmitter off and check for possible wiring errors. Pay particular attention to possible shorts and polarity reversal. Also, make sure the batteries are fresh.

The long reach. Range test the completed communicators for maximum DX with the help of a friend. First, align the optical elements of both transmitter and receiver. For the transmitter, adjust the position of the amplifier board until the LED fills the aperture of the lens when the lens is observed several feet distant. Adjust the receiver's solar cells so that the entire reflector takes on the dark color of the cells when observed straight-on. This means that all light striking the reflector will be reflected to the cells.

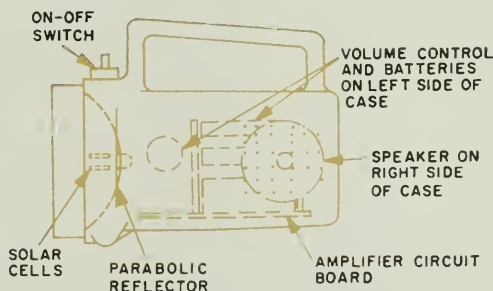
When the units are aligned, leave the transmitter and its operator at a fixed location, and slowly walk away while directing the receiver toward the point of maximum signal. Instruct the transmitter operator to count into the microphone. As the range is increased, reception will be more difficult (because of alignment), but the signal from



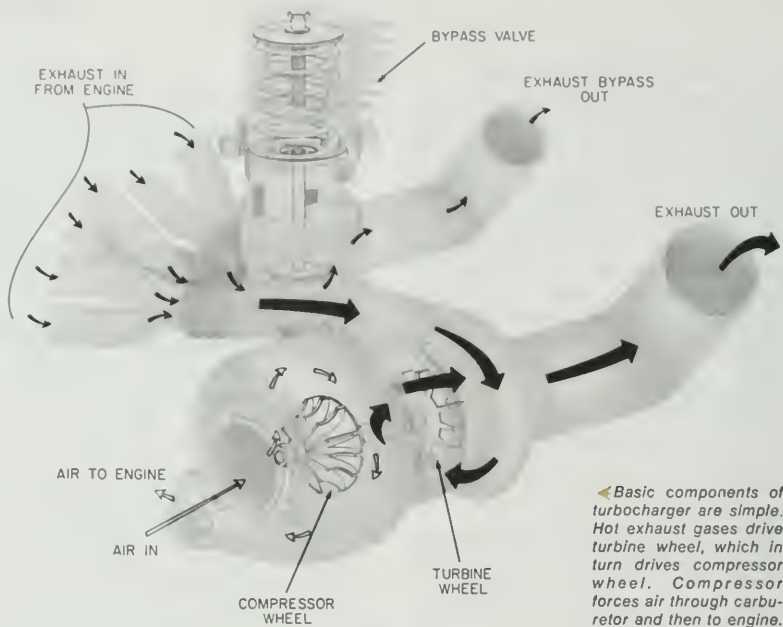
▲ Light communications transmitter.

the transmitter should be receivable at about 1,000 feet at night. Range will be dependent on the size of the receiver's reflector. Daylight operation will result in considerably reduced range due to saturation of the detector solar cells. The problem can be partially alleviated by placing a cardboard tube over the front of the receiver to shield the detector from stray sunlight. Reception can be further improved by placing an infrared filter over the receiver detector. These optical shielding techniques will also reduce effects of buzz and hum from artificial light sources.

See also: ELECTRONICS.



▲ Light communications receiver.



Turbocharge Your Compact Car

Use a kit to get big performance of your mini's little engine

THE CURRENT TREND toward the smaller cars with smaller engines is destined to last for a long time. It just doesn't make sense for the American motorist to continue his support of overcrowded cars on overcrowded roads. The smaller size car, which we've come to know as "mini," offers economy, practical size and relatively decent all-round transportation. However, it generally lacks performance even near to equal that of a standard size U.S. sedan. That's to be expected since the minis have small size engines plus a host of emission controls.

There are a number of ways to remedy

this low-performance of the mini. These include the traditional hot rod sort of applications like multiple carburetion, higher lift camshafts, and bigger exhaust systems. The drawback to this approach is that when installed by the average mechanic, the low emission character of the powerplant is lost. And this is something for which the owner can be penalized in some states if his new car happens to fail an inspection by his motor vehicle department. Polluting the atmosphere is a poor way of getting better performance.

An alternative to the speed equipment approach is turbocharging. Turbocharging is not at all new. Turbos have been used on trucks and airplanes for years. Right now, every Detroit car maker is looking at turbocharging for possible inclusion on production line cars.

compactor: see trash compactor
companion planting: see organic gardening
compass: see navigation
compost: see organic gardening

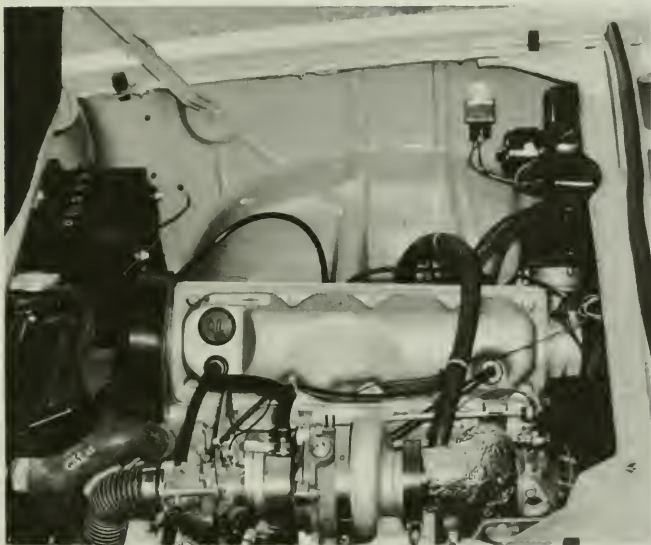
Turbocharge Your Compact Car

The way a turbocharger operates is by using the engine's exhaust to spin a turbine wheel which is connected by a shaft to a compressor wheel. The compressor side of the turbocharger is where incoming air and/or the air-fuel mixture are introduced. As the exhaust driven turbine picks up speed, the air-fuel mix is compressed and is then packed into the combustion chamber at a high rate of speed and density. The result is an improved combustion chamber charge which results in more energy produced by the engine. Some turbochargers have a waste gate so that the amount of boost can be varied throughout the engine operating speed range. The waste gate is adjusted for each application, but because the waste valve is rather expensive, its use is generally restricted to aircraft and racing cars. The current generation of small size turbos for passenger cars doesn't use or need a waste valve because they are designed to put out a maximum of 10 pounds

of boost. That's about the limit most stock engines will take.

One of the greatest advantages turbocharging offers is a reduction in unburned hydrocarbons. This is natural since the turbo is utilizing the hot engine exhaust that would otherwise exit directly out the tailpipe. Turbochargers thrive on heat. This means that the turbine wheel speed is not directly proportionate to the engine speed. As the exhaust heat increases, the heat converts to energy and this energy spins the turbine faster.

One of the characteristics of a turbocharged engine is that it doesn't have really noticeable low speed acceleration. There are exceptions of course, such as racing cars with expensive waste valves, but we're concerned here with the lower cost turbo kits for mini cars. As the engine picks up speed, the driver becomes aware of a performance increase beginning around 3000 rpm. From that point on the turbocharger



◀ Schwitzer turbocharger, installed in a Chevrolet Vega. Vega engine compartment has plenty of room to accommodate turbo.

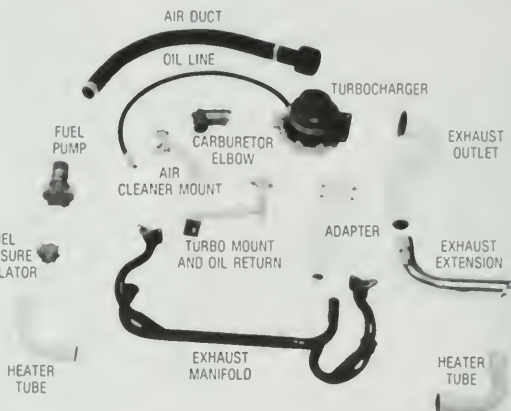
Main components of a Schwitzer Turbo-Plus kit are shown. This installation is for a VW. Deck lid is necessary because conventional VW lid will not close over turbocharger.

DECK LID



is really compressing the fuel-air mix. At peak speeds the turbine wheel, depending on the size of that particular unit, is turning between 25,000 and 40,000 rpm.

There are only three manufacturers of turbochargers in the United States. Schwitzer Division of Wallace-Murray Corporation is an Indianapolis company and a major supplier of turbochargers at the Indy 500. They've just recently introduced a complete kit for turbocharging Volkswagens and VW-powered dune buggies. The Beetle kit even includes a "bubbled" fiberglass trunk lid because the Schwitzer kit places the turbo aft of the engine making it impossible to use the stock deck lid. The Turbo Plus VW kit sells for about \$500, and the dune



buggy Turbo Plus retails for about \$400. It is money well spent when you consider that the horsepower is nearly doubled. Most people with common sense and a selection of hand tools can install the Schwitzer kit, as well as others, in one day.

Schwitzer also makes the major components used by Don Yenke, a Canonsburg, Pennsylvania, Chevrolet dealer who is now marketing a bolt-on turbo kit for the Vega. It sells for about \$600 and can even be fitted to air-conditioned models. Chevrolet engineering has been experimenting with the Yenke turbo, but neither Chevy nor Yenke can install it on a car until it has been run through a 50,000 mile endurance test in order to meet Environmental Protection Agency requirements.

One of the Ford engineers who was responsible for developing that company's turbocharged Indy 500 engine is Dan Jones, and due to his knowledge of turbocharging and relationship with Schwitzer, he has been able to design a very effective turbo Capri. His setup is good enough to make the Capri run a quarter-mile at nearly 100 mph from a standing start. Jones's rig is rather expensive in its present form but there's talk of Lincoln-Mercury adapt-

Turbocharge Your Compact Car

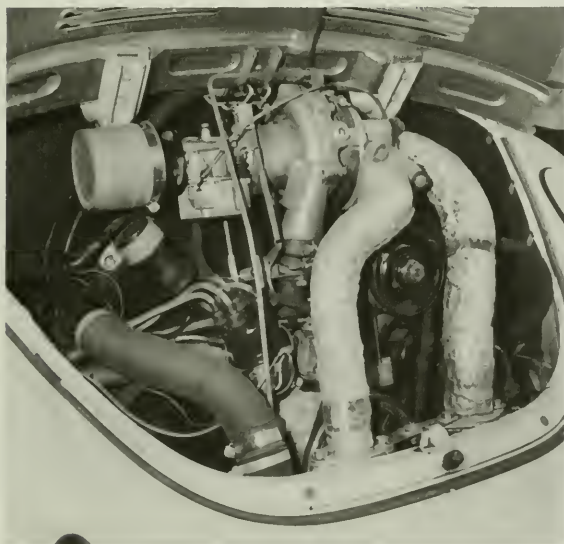
ing his system for a production line option which would greatly reduce the cost.

The other two manufacturers of turbochargers are AirResearch Corporation in Los Angeles, and Rajay Industries in Long Beach, California. AirResearch doesn't deal directly with the public, but they have been working with Ak Miller, and recently supplied Texas' A. J. Foyt with a turbocharger for his Indy Ford engined USAC car. Miller runs a garage in Pico Rivera, California. His AirResearch turbocharger kit for 2000 c.c. size Pinto engines is really a power booster. A standard pump gas-fueled Pinto with one of the Miller Air Research kits will run a quarter in about 15 seconds and produce a speed right at the 90 mph mark. Miller's kit is reaching the marketing stage after a full year of development. He estimates the full kit to be priced between five and six hundred dollars when it does go on sale.

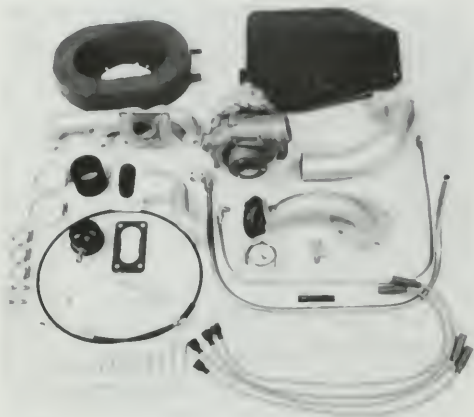
Rajay Industries works with many small

turbo kit manufacturers and also has developed kits sold through various speed shops. Their most popular unit is the VW turbo that sells in the area of \$400. It differs from the Schwitzer unit by fitting within the confines of the engine compartment, and there's no interference with the deck lid. Since turbochargers "recycle" the exhaust, this cuts way down on exhaust noise, and VW's with turbochargers can usually be operated without a muffler and still be quieter than a stock model.

Rajay also provides the turbocharger for the Pinto kit sold by Car Corporation of Livonia, Michigan, through some Ford dealers. The Car Corp. kit retails for about \$400 and is easily installed. Instructions are very complete and the components fit the engine compartment with ease. The performance level of the Car-Rajay turbo Pinto is a bit less than the Miller unit, but then the price is a lot less. Still, a Car-Rajay improved Pinto is good for mid-15-second



◀ The Rajay VW turbo kit is available for both 1300 and 1600 engines.



▲ Components of the Pinto kit from Car Corp. Installation is simple.

quarter mile elapsed times and a quarter speed in the high 80-miles per hour range.

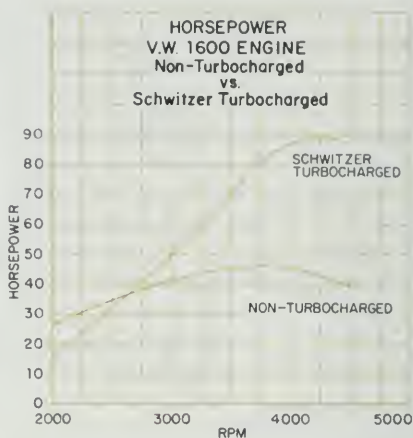
Rajay has been working with Crown Manufacturing of Costa Mesa, California, in developing a turbo kit for the Datsun 240Z. This turns the "Z" into a stormer and there's already a waiting line of 240Z owners who are ready to part with the expected \$550 price. Stock Datsun 240Z performance is somewhere in the mid-16-second bracket for a quarter-mile, but the Crown Mfg. kit enables the car to clock through the quarter in the mid-14-second range.

Turbocharging is not something the average driver or mechanic can figure out easily, and while a person can buy a single turbocharger, adapting it to his engine is far from simple. While there may not be a kit for your car right now, the way the currently produced kits have been catching on, it's only a matter of a short time before turbo kits will be available for all popular mini cars.

T.C.

See also: ENGINE.

Turbocharge Your Compact Car



▲ Horsepower curve for non-turbocharged VW engine vs. the same engine turbocharged.



▲ Schwitzer Turbo-Plus in a '71 VW sedan. Deck lid is supplied in kit.

How to Mix and Pour Concrete

No matter what project you have in mind, these principles will give you a professional-quality job

WHAT IS CEMENT? Concrete? Mortar? Following are some basic facts on these materials.

Portland cement is an extremely fine powder manufactured in a cement plant. Portland cement, when mixed with water, forms a paste. This paste binds materials such as sand and gravel or crushed stone (aggregate) into *concrete*.

The quality of the paste determines the strength and durability of the finished concrete; too much mixing water makes the paste thin and weak. For example, concrete made with a mix containing 6 gallons of water per bag of cement will be about 40 per cent stronger than the same concrete mix made with 8 gallons of water per bag of cement.

Water for mixing should be clean and free of oil, acid, and other injurious substances. Usually drinking water may be used for making concrete.

Fine aggregate consists of sand; coarse aggregate consists of gravel, crushed stone, or air-cooled slag. Good, sound aggregate is necessary for making quality concrete. Loam, clay, dirt, and vegetable matter are detrimental to concrete, and aggregate containing these materials should not be used.

Mortar is a mixture of mortar sand, masonry cement, and water. Mortar is used



▲ *Ready-mix concrete is ideal for many jobs. It eliminates proportioning and mixing at the site.*

for laying concrete block, brick, and stone, and for plaster and stucco coats.

Various types of cements are manufactured for every use. Normal portland cement is gray. If white concrete is needed or desired, as in flower pots, lawn ornaments, or other decorative work, use *white portland cement*.

High-early-strength cement hardens more quickly than normal portland cement and is used where high strength is needed in a shorter time. It is also often used in cold-weather concreting.

Air-entraining portland cement contains an agent which forms billions of microscopic air bubbles in concrete. When hardened, air-entrained concrete virtually eliminates sealing due to freezing and thawing. It also resists sealing due to de-icing salts. All concrete exposed to freezing and thawing or de-icing salts should be air-entrained concrete.

Concrete. The table gives the approximate amounts of materials needed for various size batches of concrete. It may be

MATERIALS NEEDED FOR CONCRETE

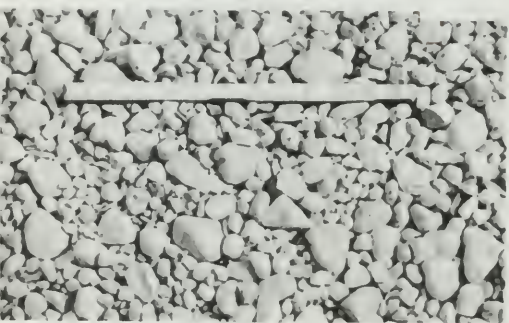
Concrete Required cu.ft.	Cement lb.	Max. Amount of Water to Use. gal.		Sand lb.	Coarse Aggre- gate lb.
		U.S.	Imperial		
1	24	1 ¹ / ₄	1	52	78
3	71	3 ³ / ₄	3 ¹ / ₈	156	233
5	118	6 ¹ / ₄	5 ¹ / ₄	260	389
6 ³ / ₄ (1 ¹ / ₄ cu. yd.)	165	8	6 ³ / ₄	350	525
13 ¹ / ₂ (1 ¹ / ₂ cu. yd.)	294	16	13 ¹ / ₂	700	1,050
27 (1 cu. yd.)	588	32	27	1,400	2,100

NOTE: U.S. bag of cement weighs 94 lb. Canadian bag of cement weighs 80 lb.

A 1:2¹/₄:3 mix=1 part cement to 2¹/₄ parts sand to 3 parts 1-in. max. aggregate.



▲ Sand and gravel used for concrete or mortar should be well graded and clean. ▼



How to Mix and Pour Concrete

necessary to vary the amounts of aggregates slightly, depending on their characteristics.

The amount of concrete needed can be quickly found for any square or rectangular areas by taking measurements in feet and using this formula:

$$\frac{\text{Width} \times \text{Length} \times \text{Thickness}}{27} = \text{cu. yd.}$$

Mixing concrete. Make a trial mix using the amounts of materials shown in the table. If this mix does not give satisfactory workability, vary the amounts of aggregate used. *Do not vary the amounts of cement and water.*

All concrete should be mixed thoroughly until uniform in appearance. Add some of the mixing water, then the gravel and cement, then sand and the balance of the mixing water. Each piece of aggregate should be completely coated with cement paste.

When hand mixing small jobs, mix the dry materials (cement and aggregate) in a container or on a suitable hard surface. Make a depression in the pile and add some of the mixing water. Continue mixing and add the remainder of the measured amount of water. The mix should be workable. If the mix is too dry, reduce the amount of sand and gravel in the next batch; if too

▼ A concrete edging tool gives the concrete slab a rounded corner that will resist breaking or chipping.



How to Mix and Pour Concrete

wet, add more aggregate. Never change the ratio of water and cement.

Ready-mixed concrete. For larger jobs consider using ready-mixed concrete; this eliminates the work of mixing and proportioning. It is as easy to order as picking up the phone. When ordering ready-mixed concrete remember the numbers 6-6-6. These stand for 6 bags of cement per cubic yard, 6 gal. of water per bag of cement, and 6 per cent entrained air.

You should be prepared when the concrete arrives. Be sure that all ground preparations have been completed, that forms are coated with light form oil and that equipment and sufficient help are on hand.

Placing concrete. Concrete should not be placed on frozen earth, mud, or earth covered with standing water. If the supporting earth is extremely dry, it should be dampened to prevent absorption of the mixing water in the concrete. Chutes are recommended when the concrete is dropped more than three or four feet.

Striking off concrete. After the concrete is placed, it is struck off with a straight-edge, usually a 2x4. The stakes holding the forms should be cut off even with the top of the forms to permit continuous movement of the strike-off board. One to three strike-off passes should be sufficient. A trowel or spade can be worked along the face of the forms to give a smooth side surface to the concrete.

Finishing concrete. The type of finish depends upon the finishing tools used. A float gives a gritty texture. When a rougher texture is desired, the surface is floated and then broomed by dragging a stiff-then broomed by dragging a stiff-bristle broom across the concrete. The stiffness of the bristles and the pressure applied determine the degree of roughness. Float and broomed finishes are recommended for sidewalks, driveways, and ramps. Steel-troweling gives a smooth finish that does not always provide sufficient footing.

Floors, patios and basement floors are a few places where a steel-trowel finish is often used.

After the concrete has been struck off, it is floated with a light metal float. A float with a long handle is excellent for finishing flat slabs. A final floating with a hand float is often given. Brooming is usually done after floating. Steel-troweling is also done after floating. The proper time to begin steel-troweling is critical. Premature troweling causes a mixture of water, cement, and fine sand to work to the surface, resulting in poorer wearability and surface crazing. Troweling should be done after water sheen has disappeared. *Do not sprinkle water or dry cement on the surface.*

An edging tool used between the concrete and the form will produce a smooth, rounded edge that will resist breaking and chipping. The edging tool should be used early while the concrete is still plastic.

Curing concrete. After finishing, the concrete must be cured. Up to 50 per cent more strength can be developed if fresh concrete is properly cured. Curing is one of the most inexpensive ways to ensure a long-lasting, satisfactory job.

Plastic sheeting or waterproof paper placed over the concrete soon after finishing is an economical method of curing. Sand, straw, burlap, and other materials that are kept continuously wet for at least six days may be used to cure the fresh concrete. Forms left in place for several days will also help cure concrete.

Colored concrete. Attractive, long-lasting colors add to the beauty of many concrete improvements. Pleasing colors can be obtained for almost any color scheme. Bright spots of contrasting colors tastefully placed make the improvement more inviting.

Colors, textures, and patterns all contribute to the unlimited design possibilities of concrete around the home. Colored concrete is usually made in one of four ways:

(1) mixing a mineral oxide pigment in the concrete, (2) working a mineral oxide pigment into the surface of the concrete after it is placed but while it is still workable, (3) using colored aggregate and leaving it exposed, or (4) by applying commercial acid stains as a special surface finish.

For true colors, white portland cement and white or light colored aggregates should be used.

Not more than nine pounds of pigment should be used for each bag of cement. Directions of the pigment manufacturers should be followed.

Concrete patterns and finishes. Patios, walks, flagstones, and other outdoor improvements may be made more decorative, or rugged in appearance by exposing the surface aggregate of the concrete. Selection of the proper aggregate is the key to getting the color desired. Use 1/2- to 3/4-inch aggregate such as marble chips, granite screenings, slag, garnet sand, or colored rock materials.

To obtain exposed-aggregate concrete, mix and place ordinary concrete in the usual manner. As soon as the slab has been screeded (struck off) and floated, scatter the colored aggregate evenly over the surface of the concrete. Push the colored aggregate just below the surface of the

How to Mix and Pour Concrete

concrete by patting with a wood float. After the concrete firms up, use a magnesium float to be sure that all the aggregate is embedded below the surface. After the concrete starts to harden, take a stiff brush and carefully work the cement-sand mortar away from the top portion of the colored aggregate. A fine water spray used in a limited amount will help.

Unique finishes may be imparted to concrete work from the inner surfaces of forms. A glassy smoothness is obtained by using polyethylene or plastic liners.

Rough texture or patterned textures are obtained by use of paneling, rough lumber, or insert strips placed on the forms.

Patterns on flat work. Geometric designs make decorative patterns in concrete surfaces. Random patterns may be made in concrete by the use of a bent piece of 3/4-inch copper pipe about 18 inches long. Circles, squares, ovals, and other designs may be made with household cans of various sizes by impressing the can surface in the semi-hardened concrete.

Wavy broom finishes can be used to give variety to concrete surfaces. These textures also assure a nonslip surface.

Leaf impressions result in interesting and decorative patterns. Press the leaves stem side down into freshly troweled concrete. Embed the leaf completely, but do not allow the concrete to cover the top of the leaf. Carefully remove the leaf after the concrete sets.

By getting the proper equipment ready, by preparing the forms correctly, and by mixing quality concrete in the correct proportions, you can complete your home improvement projects in less time with less labor and worry. Useful concrete improvements will make living more comfortable and convenient, and your finished concrete projects will be an attractive addition to your home and yard.

See also: BRICKWORK.

CONCRETE COLOR GUIDE

Color desired	Materials to use
White	White portland cement, white sand
Brown	Burnt umber, or brown oxide of iron (Yellow oxide of iron will modify color)
Buff	Yellow ocher, yellow oxide of iron
Grey	Normal portland cement
Green	Chromium oxide (yellow oxide of iron will shade)
Pink	Red oxide of iron (small amount)
Rose	Red oxide of iron
Cream	Yellow oxide of iron

◀ Brooming provides an attractive non-slip surface.

▼ Floating a concrete slab.



▲ For an exposed aggregate finish, first float the concrete in the ordinary way, then scatter aggregate over the surface and push it down just below the surface with the float. Wait for the concrete to begin to harden.



➤ When the concrete begins to harden, expose the aggregate just below the surface by removing some of the concrete with a brush and by using a fine spray of water sparingly.

How to Repair Masonry

New materials have improved ability to bond with existing concrete or brick and resist cracking, chipping, spalling

REPAIRS OF CRACKED and broken concrete around the home have long been a frustrating task for many homeowners. However carefully they did the job, the repair would seldom stand up under heavy rains and winter frost. The problem of bonding the patch to old concrete now has been solved, providing assured success when done properly with the improved materials.

The breakthrough results from additives that provide better bonding to the existing concrete. One form consists of vinyl liquid that is mixed to a uniform consistency with cement, sand, and asbestos fibers. The mixture can be troweled down to ¼-inch thickness and works well also for smoothing rough surfaces and repairing hairline cracks. It has greater strength than standard concrete mixes, resists cracking and chipping, and is not affected by freezing.

The toughest and most expensive masonry patcher is epoxy cement, which is a two-part mixture of emulsion and hardener, mixed in equal parts just before using because it sets very quickly. The epoxy mixture may be combined with regular cement as an additive for greater adhesion, and is often used to seal leaks in foundation walls.



▲ *Widen and roughen area to be patched with a chisel, removing all loose and crumbling concrete. Undercut the sides, if possible, and remove some of the earth in the opening so that concrete will pack into the space beneath the slab and become locked in.*

Another useful form of patching cement comes in cartridges, similar to those for caulking. It is used in a regular caulking gun. This form is useful for repairing fine cracks and for replacement of crumbling mortar in brick and stonework.

In addition, these patching materials can be purchased in small sacks of various mixtures for specific purposes, such as mortar, sand, and gravel mixes. There is, of course, a considerable reduction in waste when a 10-pound sack can be opened for a small repair job, and, perhaps homeowners are grateful they need not carry 80-pound standard sacks, plus the extra sand and gravel, and worry about disposing of the excess.

Generally, patching cement is mixed to a thick consistency with only enough water to moisten the ingredients. Some situations may require a thinner mix, sufficiently fluid for pouring into a crevice that cannot be reached for troweling.

How to Repair Masonry

Tools needed. A hammer and chisel to widen the concrete crack, a pointed trowel, and a pail for mixing the cement are all you need to make most patches. If the area of broken concrete is fairly large and you will need a considerable amount of cement, do the mixing in a wheelbarrow. For brick mortar repairs, a jointing tool will be useful to strike the mortar joints so that they match the rest of the wall.

Preparing the mix. Small amounts may be mixed in any clean container of glass, pottery, plastic, even paper. For mixing latex cement, place some of the powder into a bowl and add just enough water to form a thick paste. If the cement will be used for a thin hairline crack, start with a thick paste, let it stand for a minute, then stir thoroughly to obtain a consistency of heavy batter, which will be just fluid enough to pour, but not watery. If it is necessary to add water, do it very sparingly; the thicker mixture makes a stronger cement.

A plastic consistency, almost like putty, is better for larger patches. Add just enough water to the powder to moisten all the ingredients, turning frequently with the trowel so that no dry materials remain on the bottom. The resulting mix will be smooth and dry when compressed with the flat blade of the trowel, without free water rising to the top.

Mix just enough for no more than 10 minutes of work. The cement will begin to set in that time and no longer be workable. Use ordinary portland cement and sand, with a vinyl additive as a bonding agent for the average repair of broken concrete; use vinyl latex emulsion mixture for repairs of small cracks and for leveling and smoothing uneven concrete; use latex cement for coating coarse cement when a thin layer is desired, and for patches that will be under some pressure, as in foundation wall repairs, also for replacing broken corners of slabs and other concrete forms.

Filling sidewalk cracks. Use a chisel to

clean away all loose and crumbling segments, then chip away as much material as you can to widen the crack, undercutting the sides so that they slope inward from the surface to provide a better joint. With a stiff wire brush, clean the old concrete surface to remove all dirt and mud. If the opening is muddy, use the exhaust end of the vacuum cleaner to blow out the water. Use the concrete mix with vinyl additive to pack the opening, then smooth it flush with the adjacent surface. If the space underneath the opening is muddy, fill to the level of the original concrete with sand or gravel, then pack in the repair cement.

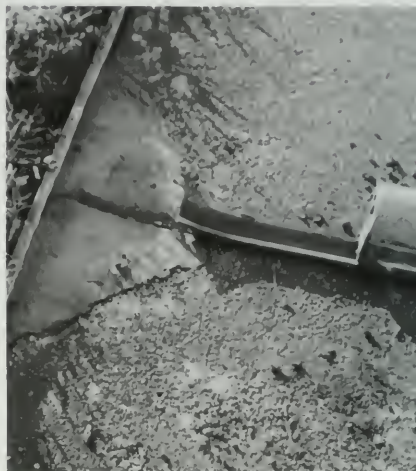
Broken corners of concrete slabs—including the edges of driveway runways, sidewalk slabs, and patios—formerly were impossible to repair because the added patch was easily broken. Latex binder additives will provide a good bond. The repair requires installation of a form around the corner—this may be a couple of pieces of hardboard tapped into place and held

✦ *Clean sides of the break with a stiff brush to remove dirt and mud that would prevent bonding of the patching cement.*





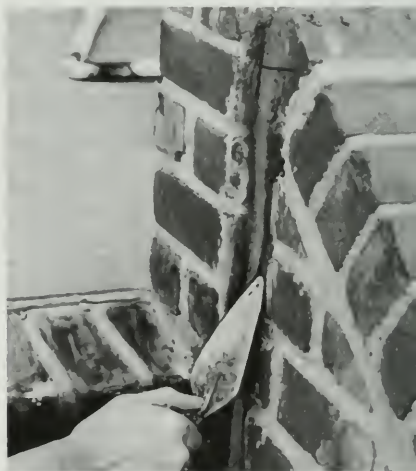
▲ Base of opening receives stones or sand that form aggregates which become part of the newly-poured concrete patching material.



▲ After cement has been troweled in place, allow it to set, then use a jointing tool to form the groove of the expansion joint.



▲ To repair brickwork, chisel out the split segments. Then work vinyl cement into the area to be patched.



▲ Vinyl cement additives assure a permanent bond in the repair of brickwork and other masonry.

How to Repair Masonry

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◀ Mixing concrete on driveway apron or other surface will cause staining. Use any convenient container, such as a wheelbarrow, or make a box which can be discarded after use.



▲ To form a putty-like anchoring compound for application in vertical walls, use very little water. Even if the mixture seems dry and crumbly, hesitate about adding liquid. ▼



▲ When the anchoring compound is mixed, force a little into the hole with the fixture to be mounted so that the hole is about half filled. Tap the fixture lightly with a hammer several times to make the compound flow around it.

➤ Fill the remainder of the hole with anchoring compound and smooth it flush with the surface of the wall. Use your fingers or a trowel. If the compound becomes too runny, give it a few minutes to stiffen. Wait about an hour before putting any strain on the fixture.



with stakes driven into the ground to be removed after the cement hardens.

Restoring roughened slab. Heavy rains, plus the expansion and contraction of temperature changes, will sometimes cause the top of a sidewalk to chip and spall, resulting in a rough and untidy appearance. A smooth new topping can be applied with epoxy cement, spread in a layer of only $\frac{1}{8}$ - or $\frac{1}{4}$ -inch. This method also can be used for correcting the pitch of a patio or other concrete surface to assure proper rainwater drainage. Make sure the surface is perfectly clean. If there is paint on the surface, it will be necessary to use a solution of muriatic acid. Two 1/16-inch layers, almost as thin as a coating of paint, will provide a smoother and more durable result.

Match the color. While your patching effort will be successful, you may regret it if the color is so different from the original slab that the patch stands out and seemingly dominates everything in sight. The usual portland cement is quite light in



★ Anchoring compound used to embed the post in concrete was mixed to a flowing consistency, then poured in place. After pouring, the post was tapped lightly with a hammer and mixture was troweled smooth.

How to Repair Masonry

color, while your sidewalk probably is much darker, or the brick mortar will be much different from the mortar used in brick pointing.

The best way to handle this is to color the concrete when you use it, adding the necessary dye or pigments right in the mixture. Ordinarily, lampblack is used to darken portland cement, while various pigments may be used if necessary to match a colored patio or terrace. The problem is that you will find it difficult to predict the true color of the cement when it dries. The only real way to do this is to mix a batch and let it dry for a couple of days, but this can run into an extended project if you keep changing the amount of pigment and must wait a few days between each change. The best that you can do, if it is necessary to get on with the job, is to make a fair estimate of the degree of color tinting desired, keeping in mind that it usually dries lighter. You still have the satisfaction of knowing that you made a reasonable effort to obtain a match.

Another use for patching compound is to anchor posts, bolts, hooks and other fixtures in masonry floors and walls. The more specialized of these compounds expand slightly as they harden and form extremely strong beds for hardware. They also make strong patches for cracks and holes, although they cannot be spread as thinly as other patching compounds.

Anchoring compounds can be mixed in either a pouring consistency for work on horizontal surfaces, as in anchoring posts for railings, and in a thicker putty-like mixture for mounting hooks or bolts or the like in vertical walls. Study the directions carefully and always use as little water as possible.

Also, make sure the mounting hole or crack to be filled has a clean, dust-free surface. Some anchoring compounds require that the surface be moist, but not wet.

See also: BRICKWORK; DRIVEWAYS; MASONRY.



How to Create Decorative Block Screens and Partitions

Improve the appearance of your home with decorative blocks that can be intermixed to form interesting and functional partitions

YOU DON'T HAVE to be a skilled brick mason to install this lightweight decorative stone block that can be used for home and yard improvements to create a feeling of privacy without sacrificing air or light.

The only tools you need are a hammer, saw, level, straightedge, steel and wooden squares, and a few tubes or cans of mastic.

The block forms used here are com-

pounded of cement and micro-ground minerals. Similar in texture to normal grey cement, the blocks are weather resistant and require no special care. However, they can be painted with an exterior masonry paint if you want to achieve a special color effect.

Because of their light weight, which averages around 12 pounds per square foot of block wall area, no special footing or foundation is required, providing the walls do not exceed 6 feet in height. If the wall is to be higher, check with your lumber or building materials dealer to find out about the required outdoor footing or how much weight your flooring can safely carry per square foot.

To work out your own pattern designs make several cardboard cutouts, drawn to

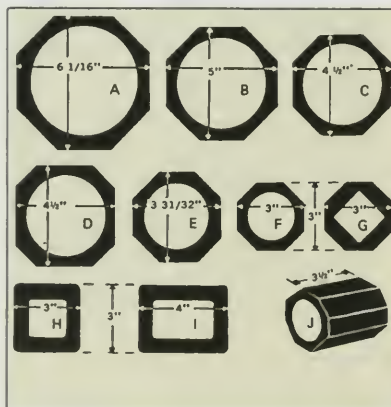
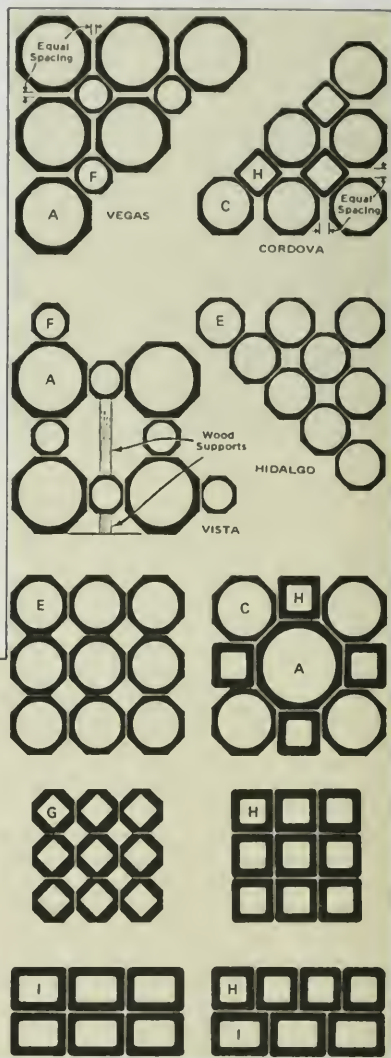
half scale, of each size and shape and arrange them on a flat surface until you get the desired pattern. Some of the more popular patterns are those which are the easiest to lay.

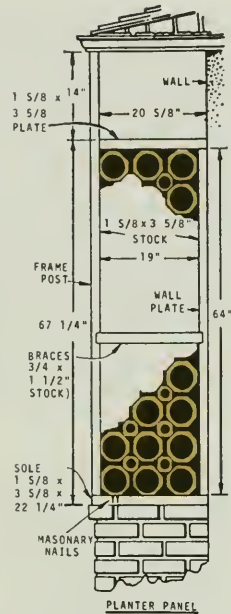
Frame measurements must be precise and the upright members aligned on a true vertical to the base. Dimensions of frames used here, as designated in the Materials List for the drawings, are actual size and may be changed to meet your requirements.

Making the frames. To determine the correct size of any given frame for patterns made up of the same size and shape of blocks, arrange two boards on a flat surface at a 90° angle to each other and lay a row of blocks alongside each other until the required height and width is reached. When sawing the frame boards to length, allow about a 1/4-inch maximum joint to each six linear foot of stone.

Patterns which place the block joints at a 45° angle require special bracing. Because of an expanding action that takes place in the frame when the block is laid, cross braces are nailed across the frame to prevent the sides from bending outward. The braces can be removed 24 hours after

Shown are some of the block shapes available and the more popular pattern designs.





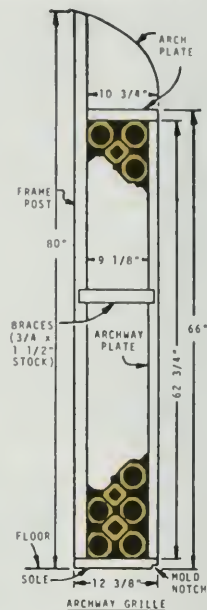
◀ Planter panel adds to the appearance of the porch and prevents the late afternoon sun from penetrating the window at the right.

MATERIALS LIST—Planter Panel

Quantity	Size and Description	Purpose
1	1 5/8" 3 5/8"x81 1/4" fir or hemlock	frame post
1	1 5/8" 3 5/8"x64" fir or hemlock	frame upright
1	1 5/8" 3 5/8"x22 1/4" fir or hemlock	frame sole
1	1 5/8" 3 5/8"x20 5/8" fir or hemlock	frame plate
1	3/4" 1 1/2"x22" pine	brace



◀ An otherwise plain archway is brought up-to-date with grilles made of square and octagon shaped stone blocks.



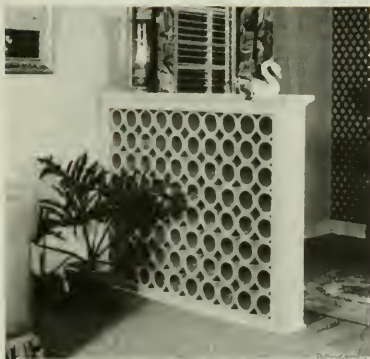
◀ Paving bricks prevent boards from shifting when laying out stone blocks and make it possible to determine the correct size of the frame.

MATERIALS LIST—Archway Grille

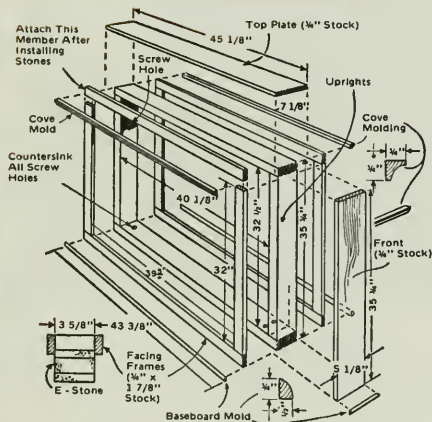
Quantity	Size and Description	Purpose
2	1 5/8" 3 5/8"x80" fir or hemlock	frame post
2	1 5/8" 3 5/8"x66" fir or hemlock	frame upright
2	1 5/8" 3 5/8"x12 3/8" fir or hemlock	frame sole
2	1 5/8" 3 5/8"x10 3/4" fir or hemlock	frame plate
1	1/2" 3/4"x64" pine (optional)	baseboard molding
2	3/4" 1 1/2"x12" pine	horizontal brace

MATERIALS LIST—Room Divider

Quantity	Size and Description	Purpose
2	1½" 3½"x32½" fir or hemlock	frame upright
2	1½" 3½"x43½" fir or hemlock	frame bottom and frame plate
4	¾" 1⅞"x32" pine	vertical facing
4	¾" 1⅞"x43½" pine	horizontal facing
1	¾" 5⅞"x35¼" pine	front piece
1	¾" 7⅞"x45⅞" pine	top plate
1	½" ¾"x98" pine	baseboard molding
1	¾" ¾"x98" pine	cove molding
as needed	#12 3" flat head screws	
as needed	#12 4" flat head screws	



▲ Room dividers can be installed almost anywhere because the lightweight stone, in many instances, requires no extra foundation.



the blocks are laid. A 3½-inch square post does not require bracing.

The panel wall, which is 7 ft. high, can be made any length, depending upon available space and type of floor construction. Frame material used in this panel is cut from 1½ x 3½-inch stock and divided off in five sections by uprights. Two of the uprights extend to the ceiling for lateral support. Corner braces, ½ x 2 inches, are used to anchor the top plates to the ex-

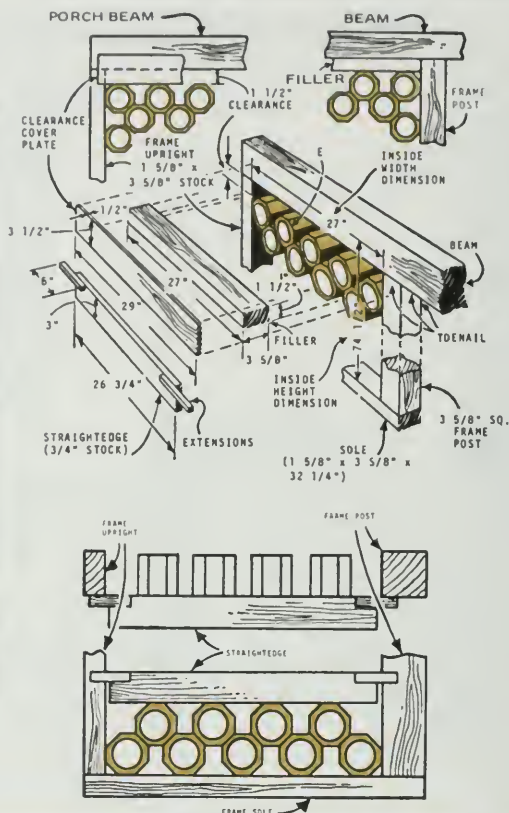
tended uprights. These uprights are fastened to the ceiling joists that run parallel to the panel.

The room divider can be attached to a wall, wall stud, or the floor. After you make the inner frame, screw-fasten the unit to the floor with three #12 x 3-inch flat head screws and to the wall stud with one #12 x 4-inch screw. If no wall stud is available, attach the frame to the wall with a toggle bolt wall fastener, available at lum-

How to Create Decorative Block Screens and Partitions



▲ Porch panel provides some privacy. Space between the top row of blocks and the porch beam is finished off with a cover plate.

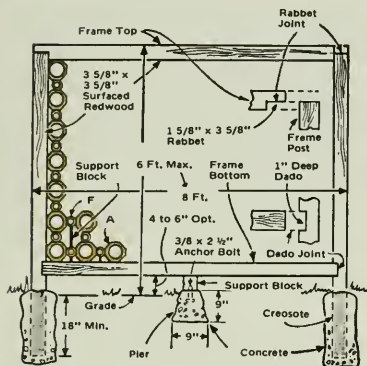


MATERIALS LIST—Porch Panel

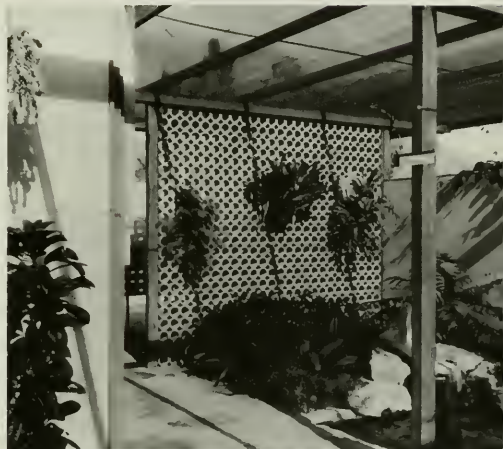
Quantity	Size and Description	Purpose
1	3 5/8" 3 5/8" x 74 1/2" fir or hemlock	frame post
1	1 5/8" 3 5/8" x 74 1/2" fir or hemlock	frame upright
1	1 5/8" 3 5/8" x 32 1/4" redwood	frame sole
1	1 1/2" 3 5/8" x 27" fir or hemlock (optional)	filler
1	1/2" 3 1/2" x 29" pine (optional)	cover plate
1	3/4" 3" x 26 3/4" pine (length optional)	straightedge body
2	3/4" 3/4" x 6" pine	straightedge extensions

MATERIALS LIST—Patio Panel

Quantity	Size and Description	Purpose
2	3 5/8" 3 5/8"x88" redwood	frame post
1	3 5/8" 3 5/8"x90 3/4" redwood	frame sole
1	3 5/8" 3 5/8"x96" redwood	frame plate
1	3 5/8" 3 5/8"x5" redwood	support block
1	3/8"x2 1/2" anchor bolt	pier to block



➤ Patio panel adds to the appearance of the back yard and gives privacy without sacrificing air or light.



ber and hardware stores. Sand all surfaces of the frame with No. 2/0 paper and apply a coat of interior primer. When dry, smooth with No. 000 steel wool. Remove all dust and apply two coats of an interior enamel to the inner surfaces of the frame and facing strips.

Install the blocks after the paint is dry. After 24 hours, attach the other facing strip and molding. Recess the nails and apply a coat of primer. Fill all imperfections with spackling putty. Remove the excess spackle by sanding and repeat the enameling process.

Construction of a frame for a porch panel often results in a space at the top that has to be filled in with a filler board or

a cover plate. By using a 3 5/8-inch square corner post for the frame, it is not necessary to use a re-enforcing brace. Toenail the top of the post to the porch beam. The straightedge helps keep the face sides and top of the blocks aligned.

The frame for a patio panel is installed between the existing posts supporting an overhead covering in a corner of the garden. The lower portions of the posts are saturated with creosote and imbedded at least 18 inches in the concrete piers. The center of the frame is supported by a 9 x 9-inch concrete pier and a wooden block that is attached to the pier with an anchor bolt. Allow the concrete to harden for 48 hours before installing the blocks.

Laying the stone blocks. Block patterns having vertical and horizontal joints are the easiest to lay because they touch on all four sides and support each other.

Apply a $\frac{3}{8}$ -inch wide ribbon of mastic at the left and bottom surfaces of the block that contacts the frame or another block. Allow $\frac{1}{2}$ -inch at each end of the block for expansion of the mastic and to avoid waste. Repeat this process with each block that rests on another block or on the frame. Use your straightedge to check alignment.

The blocks can be slid slightly to correct minor errors in alignment for about an hour after laying, but this should be done only when necessary. For the first 12 hours until the mastic hardens, avoid moving or jarring the blocks. Excess mastic can be re-

moved the following day with a sharp knife or chisel.

Patterns that place the joints at 45° angles require particular care in spacing the first row of blocks to maintain accuracy in each of the following rows. Designs that require open spaces beneath certain blocks should be held up with temporary filler blocks of wood to support the stone blocks.

Another way to build a block panel is to preassemble the sections on a flat surface and use both a wood and steel square to maintain accurate overall dimensions. These sections can consist of two smaller blocks adhered to a larger one, or made up to a 12-inch square with intermixed or all of one kind of stone block.

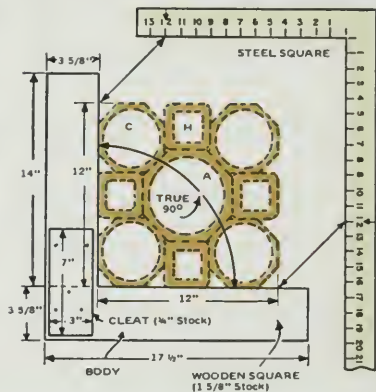
These suggestions will give you a start. You can begin your custom designing where we left off.

F.H.

See also: BRICKWORK; MASONRY; PATIOS.

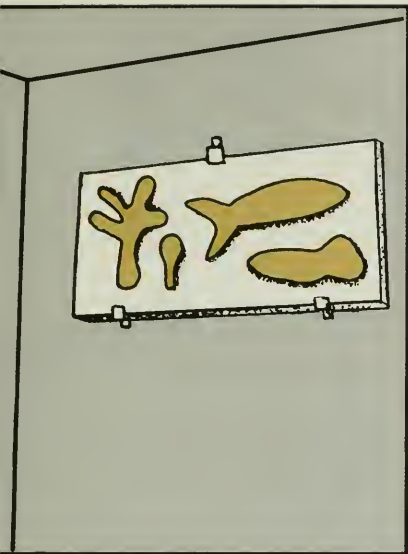


▲ Steel and wood squares are used to maintain accurate overall dimensions in pre-assembled stone block sections.



MATERIALS LIST—Wood Square

Quantity	Size and Description	Purpose
1	1 5/8" 3 5/8" x 17 1/2" fir or hemlock	body
1	1 5/8" 3 5/8" x 14" fir or hemlock	tongue
1	3/4" 3" x 7" pine	cleat



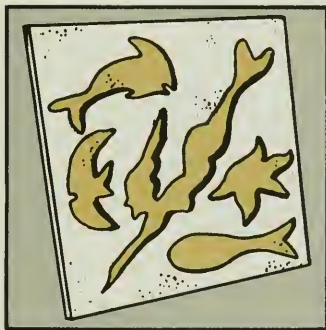
▲ It's possible to duplicate sculptured works of art with special blends of concrete mixes.

How to Cast Decorative Concrete Objects

Try a lightweight mix of cement and vermiculite to form handsome wall plaques, or try ordinary mortar for making tables and planters

THERE ARE an unlimited number of intriguing shapes that can be created with a special, light concrete mix and used to enhance any indoor or outdoor setting.

Texture can be controlled by the smoothness or roughness of the form surface and by the amount of tamping done after the mix is poured. On lightweight concrete mixes you can actually work the sur-

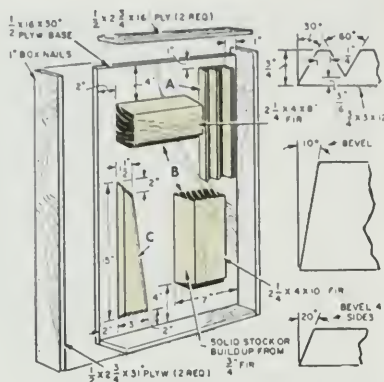


face after the pour sets and is removed from the form.

Common concrete mix consisting of pebbles and/or larger stones, sand and cement, is not the only material you have to work with. This is fine if you want weight and the structural strength it provides, but for wall plaques, heads, lamp bases and similar projects, you can develop a lightweight concrete merely by substituting vermiculite for the ordinary concrete mix. Vermiculite is sold at garden supply stores as a plant aid and is used for breaking up hard, clay-like soils. It also forms a base for accoustical plaster.

When using it as the aggregate for a concrete mix, it can be used with cement alone

concrete flags: see brickwork
concrete improvements: see masonry
conifers: see trees
connections: see electrical, auto
contact cement: see adhesives



hung on an interior wall, or set in the ground in a garden with lacy plants in front of it.

or combined with sand. It can be mixed four to one without sand and still have adequate strength. Including sand—two or three parts vermiculite to two parts sand and one part cement—will increase strength, provide a different texture, and add weight. Vermiculite, sand, and cement is still a lightweight concrete, because it is the large pebbles and stones in a common mix that contribute to most of the weight.

Ordinary mortar used for brickwork is another good material for fine detail. Just make it into a soupy mixture consisting of cement, sand and water.

Mixing is important. All the materials should be thoroughly integrated before water is added. For small projects, you can work in a pan or pail. For most of the larger projects, a wheelbarrow will do fine.

You can save money by buying the materials in bulk if you plan many projects. A yard of concrete mix—this includes aggregate and sand already mixed, and three or four bags of cement—will get you started. If you want to start off small, buy a 100 pound bag of prepared concrete or mortar mix that has all the ingredients already mixed, and just add water.

Wall plaque. This is a good project to start with. It can be used as a fence insert,

The first step is to make the form base from 1/2-inch plywood, then shape the raised pieces from solid lumber. All sides of the raised pieces are beveled to make removal easy; undercuts won't do, because they would be impossible to remove from a mold of this type. Tack-nail these pieces in place from the back side of the base after rounding off sharp corners with sandpaper. Use 3/4-inch box nails to attach the sides.

Set the form on a level surface and wet it with a light sprinkling from a hose. Put six shovels of vermiculite, four shovels of sand, and two shovels of cement in a wheelbarrow and mix thoroughly. Ideally, mixing ends when each particle of sand and vermiculite is coated with the cement. Add water slowly, mixing as you go until the mix is plastic. Too little water is better than too much.

Put the mix into the form with a small trowel, working it in around the blocks and making sure all depressions are filled. If you want a very smooth surface, sprinkle what you've poured very lightly with water and tamp it down. Tapping against the sides of the form will also help. Continue filling the form, tapping against the sides as you go, and finish by using a strip of wood as a strikeboard to level off the top. Let it set for at least two days.

How to Cast Decorative Concrete Objects

Vermiculite concrete holds water longer than a regular mix and needs a longer setting time. After the first day keep the concrete damp by sprinkling water on it. Remove the side pieces on the third day. Turn the project over and remove the base wood on the fourth day. If the blocks don't come away with the base, drive in some screws and use these as handles to pull the blocks out gently. Set the plaque in a shady place and sprinkle it every day for about 10 days.

The plaques employ a different type of mold to cast the figures. Cut the mermaid and marine figures out of $\frac{1}{2}$ -inch plywood with a saber saw, then the sides and bottom members to size. When the form is assembled with $\frac{1}{2}$ -inch box nails, the concrete base will be 1 inch and the figures raised $\frac{1}{2}$ -inch.

After the cut-outs are made, sand all figure edges then coat the pattern board with a 50-50 mixture of alcohol and shellac and sand again. When nailing the form together, be sure there are no open spaces. If any exist, fill them in with soap.

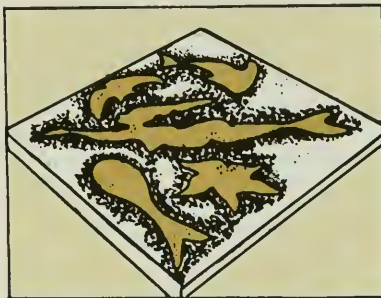
Place the form on a level surface and use a 3-2-1 vermiculite mix for the pour. The mermaid plaque requires about nine shovels of vermiculite, six shovels of sand, and three shovels of cement. The marine plaque requires just a little less.

Before pouring, coat all form surfaces

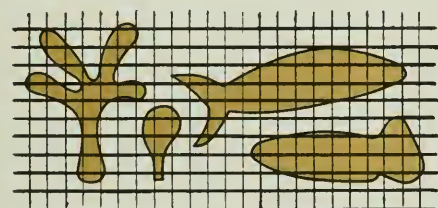
with #30 motor oil. Brush it on like paint, and don't let it pool up. Be sure to fill the cavities thoroughly. This concrete mix should be loosely packed, so sprinkle it lightly and tamp the form with the edge of a small trowel. When the form is filled to the top, strike it level. Let it set for two days, then turn it over and remove the sides and backup board.

After two more days of drying, the wood will begin to pull away from the concrete and you can remove the pattern board to fully expose the finished project.

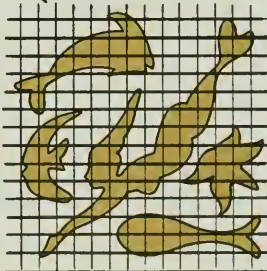
Planters are good projects for concrete, not only because of appearance but because



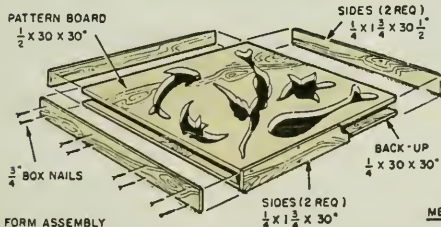
▲ After all but the pattern board is removed, carefully use a stiff brush to remove excess concrete around the edges of the cut-outs. ▼



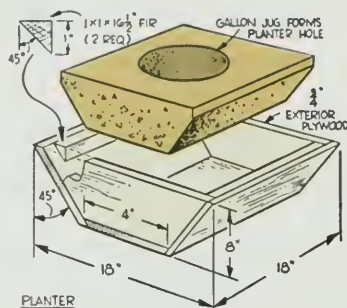
PATTERN BOARD $\frac{1}{2} \times 22 \times 48"$
 BACK-UP $\frac{1}{4} \times 22 \times 48"$
 SIDES $\frac{1}{4} \times 1 \frac{3}{4} \times 22"$ (2 REQ)
 SIDES $\frac{1}{4} \times 1 \frac{3}{4} \times 48 \div 2$ (2 REQ)



MERMAID



FORM ASSEMBLY



Small batches of concrete can be thoroughly dry-mixed in an old pan before adding water.

the concrete helps to retain moisture in the soil. A regular concrete mix—about a cubic foot—was used here. Cut the planter mold

How to Cast Decorative Concrete Objects

components to shape and dimension from a piece of $\frac{3}{4}$ x 19 x 42½-inch exterior grade plywood, then miter two strips of 1 x 1 x 16½-inch fir. Use 1½-inch box nails to assemble.

Pour about 1½-inch of mix into the form, then set a one gallon jug that's painted with oil into the concrete and finish filling the form. Be sure the jug is centered so concrete can be poured around it. After the filled form sets about 1½ hours, wash the surface with a strong stream of water. This will expose the large aggregate and provide an interesting texture.

While the concrete is setting, turn the jug occasionally to keep the concrete from adhering. In about five hours, remove the jug completely, turning it as you draw it out. Let the planter set at least a day before removing the form sections, then keep it damp and in the shade at least a week before using it.

Round planter bowls can be cast in sand. Make the mold by wetting down a mound; then tamp down and level the top. Use the outside template like a compass to remove excess sand as you turn it. If the sand is damp enough, this will produce a perfect shape.

Use a plain mortar mix—five parts sand, one part cement—and enough water to keep fairly loose. Put the inside template in place and pour small amounts of mix around the base of the dowel pivot as you turn the template. Be sure to keep the center dowel vertical so the bowl sections will be uniform. Continue pouring the mix along the sides as you turn the dowel until the form is filled. You might have to touch-up the top edges by hand after waiting about a half hour. For this touch-up job use a small trowel, dipping it in water as you work.

Sand-casting odd shapes such as a face, requires making an impression with a pattern that you can make or buy. Build a plywood box that is about four inches

How to Cast Decorative Concrete Objects

deeper, wider, and longer than the pattern and half fill it with sand. Wet the sand until water starts to stand on the surface, then press the pattern into it. Keep dampening the sand while you work it around the pattern with your fingers to shape it to the contour of the figure. Let the excess water drain off before carefully removing it. Slight irregularities can be fixed by hand.

Make a soupy mix of vermiculite or mortar and pour it slowly into the mold, using a small, rounded stick to be sure the cavity is filled. Finish pouring to the top of the box. After two days, remove the box and wash off the sand. The finer the sand used in the mold, the smoother the texture of the completed project will be.

Stepping stones can be cast in any shape. You can make two-inch-deep wooden boxes, round forms with thin sheet metal or mailing tubes, and even corrugated boxes that you cut off to a two-inch-depth for the forms. A regular concrete mix can be used, and don't do too much tamping. For an exposed aggregate surface, wash the completed form with a steady stream of water after the concrete has set for about an hour.

A concrete top patio table is an ideal piece of outdoor furniture. Small sample tiles, interesting stones, coins, and shells can be imbedded in the surface to add still more interest.

The complete form must be assembled

before any concrete is mixed. Since the wood form is not removed and must take the weather, use plenty of waterproof glue and galvanized nails for assembly. Assemble the leg framework and drill 1/4-inch holes for the carriage bolts in the leg crossbraces, then use these openings as templates to make the holes in the base of the slab form.

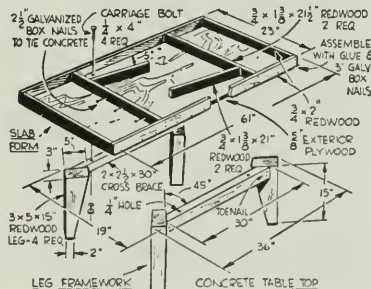
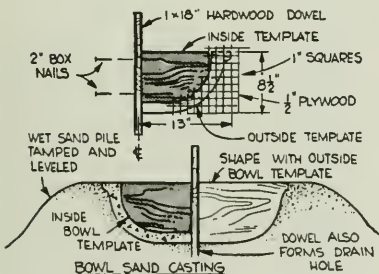
Be sure to use carriage bolts, because they can always be tightened even though you can't get at the heads. For additional stability drive 3½-inch galvanized box nails through the ¾-inch exterior-grade plywood form bottom into the legs after the bolts have been tightened.

Make a mortar mix of 12 shovels of sand to three shovels of cement and use just enough water to make a stiff mix. Pour in place and use the end of a 2x4 to tamp it down. Strike the slab level and check all corners to be sure there are no holes that will enable the mix to run out. Striking will leave a pebble finish. But if you want something smoother, work over the surface with a steel trowel after it has set for about an hour. Objects should be imbedded immediately after pouring the slab surface.

Keep the slab damp for about a week. There will be some separation between the wooden sides and mortar, but this will not be excessive.

R. J. D.

See also: MASONRY.



How to Cool Your Home without Air Conditioning

**How to reduce the
temperature inside your house
by 10 or 15 degrees
without appreciably increasing
your electrical bill.
If you use air conditioning,
these tips will reduce
its work load**

EITHER YOU INVEST a lot of money in an air conditioner, or you swelter through the long, hot summer. That's quite a threat, but not one that you have to worry about any more. There are many ways in which you can cool your house or apartment *without* air conditioning—methods of dropping the inside temperature as much as 10 to 15 degrees without the artificial environment, the clanking noise, and the high electric bills of an ugly black box jutting out of the wall.

For instance, the exterior color of the structure in which you live is very important because light colors reflect solar heat while dark ones absorb it. Studies have shown that darker colors, the blues, greens and reds, can be as much as 60 degrees hotter than the surrounding air temperature because they soak up solar heat like a dry sponge. Consequently, the same area painted white or in pastel shades will edge the thermometer up only about 20 degrees. Since some of this heat on outside walls can sneak into the living area, painting your home with white or light shades of color will automatically result in a cooler home.

The same goes for the roof, and if you're planning to build a new home or reroof the one you have, choose the lightest colored materials available. You'll be glad you did when that August sun beats down on your home.

Other methods of cutting down heat and cooling your home are just as obvious and just as overlooked. No house or apartment is hermetically sealed and even in a tightly built structure, outside air will sneak in at the rate of 50 cubic feet per minute. Houses that have many cracked or loose-fitting windows, apartments where the doors don't shut correctly, leaving gaps between the jambs and doors, and homes that have cracks in the wall or gaps in the window frames even when they're closed suffer an air infiltration rate of more than 100 cubic feet per minute. Yet for a pleasant environment, one that is balanced with fresh air and humidity along with comfortable temperatures, you need an air infiltration rate of only five cubic feet per minute. Anything else just adds to your discomfort, especially if it is a particularly muggy day.

To stop this infiltration, you can weather-

How to Cool Your Home without Air Conditioning

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strip windows and doors, keep the storm windows on all year around on the hottest walls (usually the south and west ones), putty the loose panes, caulk the cracks, and seal off all other possible air entries. Naturally, keeping the windows and doors shut as much as possible during the hottest part of the day will help, as will making sure the damper is closed on your fireplace if you have one.

Even if you live in a rented apartment, you can keep out that hot air by the above methods. You can also put plastic sheets over the inside of some windows, especially the ones that are so far gone that it would be too expensive for you or the landlord to replace, leaving them there for winter.

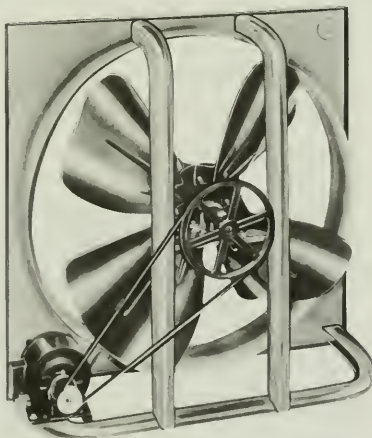
Insulation is another important step in keeping your home comfortable. A six-inch layer in your ceiling is a must. Check up in the attic or crawl space and if you have less than that minimum thickness, install your own with insulation sheets found in most lumber yards and hardware stores. Bringing that layer of insulation up to six inches in thickness will not only reduce the downward heat seepage when the roof overheats during the summer, but it will also eliminate upward heat leakage during the winter. This step will pay for itself in a short time, returning dividends of all-year-around comfort and lower utility bills.

The walls of your home should have at least three to four inches of insulation because outside heat can penetrate an un-

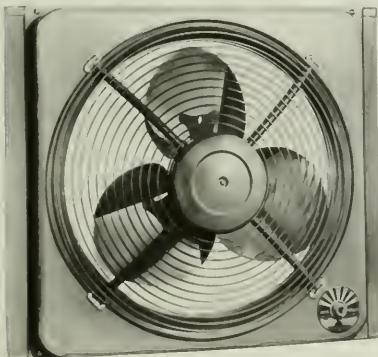
insulated wall in a one-third ratio while a properly protected wall will allow in only one-tenth. In other words, if the outside temperature is 90 degrees, an uninsulated wall will let 30 degrees of heat seep in while the protected one will keep out all but 9 degrees.

Unfortunately, replacing or installing new insulation in walls isn't as easy as it is with an unfinished attic ceiling and it would be best to consult with a building expert unless you're familiar with all the details. But either way, insulation in the walls, like the ceiling, will soon pay for itself in cooler summers, warmer winters and smaller fuel bills.

On the average, windows comprise 15 to 30 percent of exterior walls in most homes and this is slightly higher in the newer apartments. And these panes of glass are responsible for letting in more heat than any other factor. To combat this, you could buy specially tinted glass that reduces solar



▲ A window fan or an attic fan, especially one with a thermostatic control, can make a big contribution to keeping your house cool during the hot summer months. ◀



heat streaming through the windows by as much as 70 percent. These tinted panes have the added advantage of keeping out the sun's heat at the same time they let you enjoy the outside scenery. But they have the distinct disadvantage of being expensive to buy and install, especially for apartment dwellers.

Still, there is a way to slice that solar heat infiltration and that is with draperies or blinds as long as the material is opaque, light-colored and has a white backing that faces the outside. This type of drape, curtain or blind can trim the heat coming in by more than 50 percent if it covers the window during the part of the day when the sun is at its hottest.

Awnings can also be utilized to cut solar glare and heat if they are properly vented so the hot air can escape upward. Otherwise an awning, no matter if it's canvas or metal, will become a reservoir of heat surrounding the window area and as the air filters in, it can cause inside temperatures to rise.

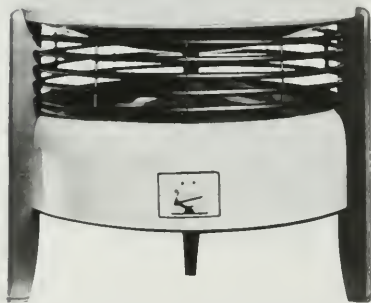
Trees are an excellent (not to mention beautiful) method of cutting solar heat, too, and if they are planted so as to protect the house and the roof from the noonday and afternoon sun, they eliminate heat build-up

on the south and west walls by some 80 percent. Of course, planting a seedling means waiting twenty years for comfort, and sticking a grown tree into the ground is expensive, costing much more than an air conditioner would. But if you're planning on buying or renting a home or apartment, checking the number and location of trees should help in deciding if it is worth the move.

As already mentioned, a house, like a living thing, breathes as air comes in and also seeps out. But by giving it "artificial respiration," and by helping your home breathe more easily, you'll benefit by enjoying cooler summers. Most homes have attic ventilation so the hotter air can escape through built-in vents. But when the summer sun beats down on your roof, the attic quickly becomes a sauna as the air temperature builds up to as much as 50 degrees hotter than the outside air. The hot air expands so that much of it can leak into the living quarters.

Again, as already detailed, insulation will cut much of this seepage, but a small circulating attic fan will slice it even more. The fan can be an inexpensive one because it has to move air at the rate of only one cubic foot per minute per square foot of ceiling area. If it is mounted in the highest part of the attic, it will keep the hot air moving out. And if the fan is controlled by a thermostat that clicks it on when the air temperature hits 100 or 110 degrees, you can forget about the fan, remembering it only when it's time to oil the bearings and clean the blades. The cost of running the fan will be about one-twentieth of a cent per hour and if your attic is inaccessible or if you're renting and don't want to spend the money for insulation, the ventilating fan is a must.

Larger attic fans are also valuable in circulating the cooler night air through the home. If you have a door or ceiling opening to the attic or crawl space, leave it open a crack at night and open the windows on



▲ Use room fans to keep the air circulating in your home.

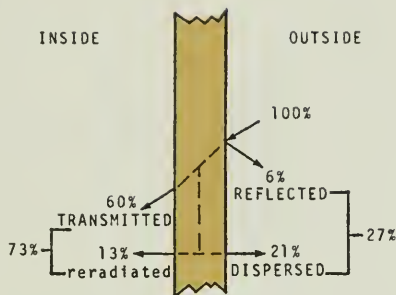
the coolest parts of the house, usually the north or east, about three inches or so. The attic fan will then draw in the cooler night air, pushing out the warmer stale atmosphere that had collected during the day. This both cools and stimulates the senses because the air coming in will carry the fragrance and soft sounds of a summer night, something the people who rely on air conditioners miss in their artificial environments.

If an attic fan isn't possible because you live in an apartment or home without an attic window, a small exhaust fan installed in the upper part of a window will do the same job at about the same cost.

Window fans, under the right conditions, can cool as well as any air conditioner for a lot less. For instance, in a room with two windows opposite each other, the fan should be installed in one so it will blow out while you open the other window a few inches. This will result in a strong breeze of cool air that will refresh and keep a room cool even during the day. Larger fans installed in central areas and one window in each room cracked open slightly will also cool the entire house or apartment as soon as the sun sets.

Another factor overlooked by most people is the heat they generate by their appliances and themselves. The average person gives off some 400 btus per hour and if you have five members in your family, that means 2000 btus are being pumped into the air every hour just by your being alive. Add this to the heat given off by light bulbs, appliances, cooking heat, washing machines, dryers and so on, and you come up with an average total of some 62,000 btus every hour.

So to avoid adding to your own discomfort, make it a habit to turn off all lights, particularly the powerful three-way bulbs, keep TV's and radios off when not being used, and plug in the appliances only when they are needed. An unused iron perched



▲ Tinted heat-reflecting window glass is expensive but it reflects 27 percent of the heat it receives from outdoors. Ordinary window glass reflects only 12½ percent. In a house with air conditioning, tinted glass will reduce electrical bills.

on an ironing board can heat up an area some fifteen degrees if it's plugged in. Also keep all cooking activities to the early morning or late evening hours if at all possible. When boiling or frying, use covered pans and install a kitchen exhaust fan in the window. Avoid the oven and electronic oven cleaning during the day, and you'll be surprised how much cooler things seem.

Finally, follow the advice of medical experts and keep yourself as cool as possible. Wear loose-fitting clothing, take lukewarm baths instead of cold showers and establish new eating habits, taking maybe four or five light meals as opposed to three heavy ones. Do physically exerting tasks early in the day or late at night when it's cooler, and avoid the direct rays of the sun.

Follow these hints and you won't have to shake your fist at the muggy air surrounding you, sapping your energy and making you feel like a limp rag. You won't have to because you'll be as cool and as comfortable as if an air conditioner were tinkling away in one corner of your home.

A.S.

See also: AIR CONDITIONERS; STORM DOORS AND WINDOWS.

Maintaining Your Car's Cooling System

This system, which keeps your engine at the proper temperature is more complicated than it looks; understanding it and keeping it in good shape will save you many hot weather headaches

THE COOLING SYSTEM is seemingly a very simple system. A pump driven by a belt draws water from the engine and pushes it through the upper radiator hose into the radiator, through which it flows, giving up heat to the air.

The coolant then flows through the lower radiator hose into the engine, where it picks up heat and the cycle starts all over again.

However, this apparently simple setup is anything but simple.

First, there is a radiator cap with two valves—one, a spring-loaded valve that seals the entire system so that as coolant expands the system becomes pressurized by as much as 17 psi (pounds per square inch), which raises the boiling point of the coolant.

The other valve is actuated by vacuum. As the coolant cools, it contracts, creating a vacuum in the system. If the vacuum valve did not open, the vacuum in the system would cause collapse of weaker parts, such as radiator tubes and hoses. The open-



▲ Using a hydrometer to determine antifreeze concentration.

ing of the valve permits air to rush in and eliminate the vacuum.

Second, there is the thermostat, a temperature-sensitive device between the pump and the upper radiator hose. This unit closes to prevent coolant from reaching the radiator when the engine is cold, speeding up coolant warm-up.

As the engine warms up, the thermostat begins to open and some coolant can flow through the upper hose.

The thermostat then maintains a position that will send just the right amount of coolant through the radiator to hold overall coolant temperature at the desired level. Coolant that is kept from going through the upper radiator hose goes instead through a bypass passage or hose on the engine.

When the outside temperature is very high, the radiator cannot dissipate heat as well, and the thermostat is wide open.

corner desk set: see desks

corner display cabinet: see cabinets

cove base molding: see floors, tiling

cradle: see furniture, children's

Maintaining Your Car's Cooling System

The fan helps the radiator dissipate heat to the air at low road speed. Driven by a belt, it draws air through the radiator.

Many cars are equipped with thermostatic fans, another little complication. This type of fan is designed to free-wheel (thus requiring no real amount of power to turn) when the engine is running cool. When the engine is running hot, a thermostatic unit engages the fan.

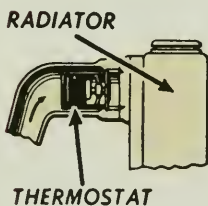
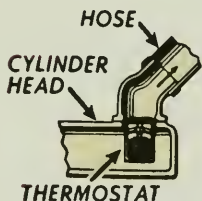
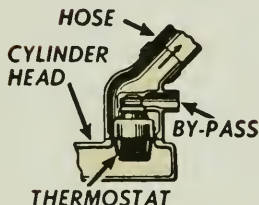
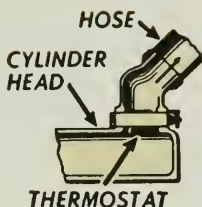
In addition to all this, there are hoses to fail, hose clamps to come loose, gaskets to fail, and a water pump to go bad.

So our seemingly simple cooling system is really something you must pay attention to, and check and service carefully. Just an annual drain, flush and fill is not enough.

Most engines use one thermostat. Some V-8's with two hoses from radiator to cylinders use two thermostats—one for each bank of cylinders. The thermostat may be mounted in any one of several spots: in the block, at the radiator hose elbow, in a secondary hose connection, or even in the radiator. Instead of playing "find-the-thermostat," check your owner's manual or a nearby garage. In most cars, the thermostat—wherever it is—can be removed by loosening two bolts.

If your engine refuses to heat quickly on cold mornings or to cool quickly on hot days, the thermostat may be at fault. If it is mis-aligned, or the valve inside it is stuck open, it will allow water to circulate freely through the radiator even when the engine temperature is below normal, and the engine may never heat. If the valve spring is worn or stuck closed, it will force the water in the cooling system to bypass the radiator—even when it's boiling—and the engine may never get a chance to cool. The remedy is a new thermostat.

Getting the right one. All thermostats are not the same. Every auto manufacturer specifies the best type and the proper heat range for his car, and in some cases may even specify one thermostat for use with



Four typical thermostat installations.

water and another for use with a permanent-type antifreeze.

Be sure to buy the right thermostat for your car. If you bought the car second-hand, don't go by the one now in the cooling system: it could be wrong. Check a thermostat catalog for the right model, heat range, and size.

Remove the thermostat, if you think there may be something wrong with it, and check for corrosion. If you can't see anything wrong, test it before you decide whether to discard it or to put it back in.

Many thermostats have their temperature ranges stamped on the casing. The lower temperature is the one at which the thermostat is supposed to begin opening, and the higher temperature the point at which it should be fully open.

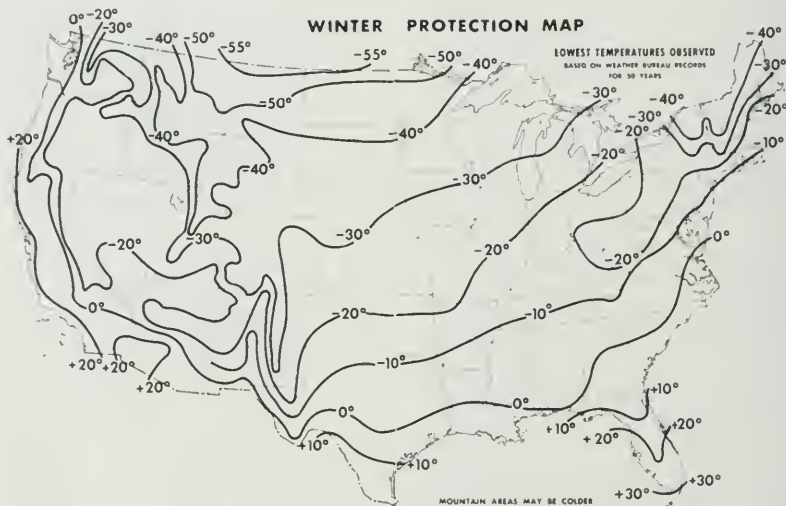
To test the thermostat, heat water on the stove to a temperature 10° below the point at which it should begin opening. Suspend the thermostat in the water for a couple of

Maintaining Your Car's Cooling System

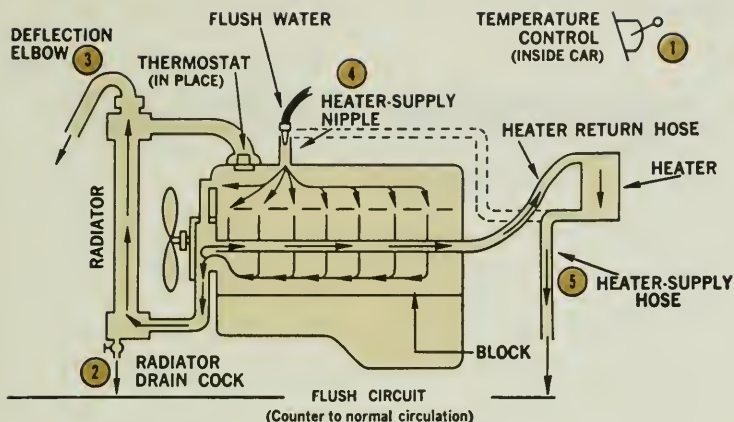
minutes. If it starts to open, discard it. If it remains closed, heat the water to a point 25° above the opening temperature, and suspend the thermostat in the water again. At this point, it should open fully; if it doesn't, discard it.

It may be necessary to remove one or more radiator hoses to remove the thermostat. Check the hoses for breaks and splits while they are off the car, and when you put them back on, be sure to clean the connections. Before you replace an engine-mounted thermostat, coat the elbow or housing with sealing compound. If the gasket is torn or chipped, replace it. Tighten the hose clamps, start the engine, and check for leaks.

Danger signs. If your engine is running hot or using water, check the hoses in both the cooling system and the heater system. Since the system is pressurized, a poor hose in either system could mean trouble. A soft-walled hose may collapse inwardly, restrict-



▲ Use this map to determine how concentrated your antifreeze solution should be.



COOLING SYSTEM FLUSHING INSTRUCTIONS

A. Set heater temperature control (1) to high. (See Note #1 if car is equipped with a vacuum-operated heater valve.)

B. Open radiator drain cock (2).

C. Remove radiator cap and install deflection elbow in the filler neck (3). This prevents excessive splash into the engine compartment. (A clear, flexible plastic tube attached to the elbow permits viewing the coolant as it drains from the system.)

D. Remove hose from heater supply nipple at the engine block (4). Point this hose downward for an auxiliary drain (5). (See Note #2 if heater supply nipple is inaccessible.)

E. Connect water supply to the heater supply nipple (4) at the engine block. CAUTION: DO NOT CONNECT WATER SUPPLY DIRECTLY TO HEATER—THIS COULD CAUSE DAMAGE. Cool flush water may be supplied through an ordinary hose or a flushing gun (cool water necessary to prevent opening of thermostat during flushing). If flushing gun has provision for air injection, air pressure should be controlled to prevent damage. (Radiator cap pressure rating may be used as a guide.)

F. Turn on water. Flush for 3-5 minutes. During the last minute of flushing, squeeze the upper radiator hose to remove any trapped liquid.

G. Turn off water (see Note #3 if antifreeze is to be installed)—remove connection at heater supply nipple (4)—reconnect heater supply hose to nipple—remove deflection elbow from radiator—permit enough water to drain from radiator drain cock to accept antifreeze—close radiator drain cock.

H. Install antifreeze—replace radiator cap—start engine and warm to operating temperature—make final check of coolant level. Check for leaks.

NOTE 1:

If car is equipped with a vacuum-operated heater valve, start engine and run at "idle" during the flushing procedure. CAUTION: SHUT OFF ENGINE BEFORE TURNING OFF WATER (primarily Chrysler products).

NOTE 2:

If heater supply nipple on the engine block is inaccessible, remove heater supply hose at heater and connect water supply to flow into engine block—not into heater. Attach a short piece of hose at heater and point downward. CAUTION: DO NOT CONNECT WATER SUPPLY DIRECTLY TO HEATER—COULD CAUSE DAMAGE.

NOTE 3:

If antifreeze is to be installed, draining from the radiator drain cock should provide sufficient space for the addition of 50% antifreeze (—34°F. protection). When greater freezing protection is required, or if it is not possible to install sufficient antifreeze, AFTER FILLING THE SYSTEM the heater hose can be removed from the heater supply nipple (4) momentarily to allow additional water to escape from the system.

SERVICE DIAGNOSIS—COOLING SYSTEM

Condition	Possible Cause	Remedy
EXTERNAL LEAKAGE	1. Loose hose clamp	1. Replace the hose clamp
	2. Hose leaking	2. Replace the hose
	3. Leaking radiator	3. Repair or replace the radiator as necessary
	4. Worn or damaged water pump seal	4. Replace the water pump seal and impeller
	5. Loose core hole plug	5. Install new core hole plug
	6. Damaged gasket, or dry gasket, if engine has been stored	6. Replace gaskets as necessary
	7. Cylinder head bolts loose, or tightened unevenly	7. Replace the cylinder head gasket and torque head in correct sequence
	8. Leak at heater connection	8. Clean the heater connections and replace the hoses and clamps if necessary
	9. Leak at water temperature sending unit	9. Tighten the water temperature sending unit
	10. Leak at water pump attaching bolt	10. Tighten the water pump attaching bolts to factory specifications
	11. Leak or exhaust manifold stud	11. Seal and re-drive the stud
	12. Cracked thermostat housing	12. Replace the thermostat housing
	13. Dented radiator inlet or outlet tube	13. Straighten the radiator inlet or outlet tube as necessary
	14. Leaking heater core	14. Repair or replace the heater core
	15. Cracked or porous water pump housing	15. Replace the water pump assembly
	16. Warped or cracked cylinder head	16. Replace the cylinder head
	17. Cracked cylinder block	17. Replace the cylinder block
	18. Sand holes or porous condition in block or head	18. Replace the cylinder block or cylinder head as necessary
	19. Faulty pressure cap	19. Replace pressure cap
	20. Loose or stripped oil cooler fittings	20. Tighten or replace as necessary
INTERNAL LEAKAGE	1. Faulty head gasket	1. Install a new head gasket
	2. Refer to causes 6, 7, 16, 17, 18, and 20 listed under External Leakage	2. Refer to corrections 6, 7, 16, 17, 18 and 20 listed under External Leakage
	3. Crack in head into valve compartment	3. Pressure test cooling system, replace the cylinder head
	4. Cracked valve port	4. Pressure test cooling system, replace the cylinder head
	5. Crack in block into push rod compartment	5. Pressure test cooling system, replace the cylinder block
	6. Cracked cylinder wall	6. Pressure test cooling system, replace the cylinder block
	7. Leaking oil cooler spring	7. Repair or replace the oil cooler
POOR CIRCULATION	1. Low coolant level	1. Fill radiator to correct level
	2. Collapsed radiator hose. (A bottom hose with faulty spring may collapse only at medium or high engine speeds)	2. Check radiator cap vacuum valve. If good, replace hose
	3. Fan belt loose, glazed or oil soaked	3. Tighten or replace the fan belt as necessary

SERVICE DIAGNOSIS—COOLING SYSTEM (Continued)

Condition	Possible Cause	Remedy
POOR CIRCULATION	4. Air leak through bottom hose	4. Reposition hose clamps or replace the hose. Check radiator outlets for dents or out-of-round
	5. Faulty thermostat	5. Replace the thermostat
	6. Water pump impeller broken or loose on shaft	6. Replace the water pump
	7. Restricted radiator core water passages	7. Flush the radiator thoroughly or rod out if necessary
OVERHEATING	8. Restricted engine water jacket	8. Flush the engine cooling system thoroughly
	1. Low coolant level	1. Fill radiator to proper level
	2. Blocked radiator air passages	2. Blow out the radiator air passages
	3. Incorrect ignition timing	3. Time the engine ignition system
	4. Low engine oil level	4. Add engine oil to the correct level
	5. Incorrect valve timing	5. Correct the engine valve timing
	6. Inaccurate temperature gauge	6. Replace the temperature gauge
	7. Restricted overflow tube	7. Remove restriction from the overflow tube
	8. Faulty radiator pressure cap or seat	8. Replace the radiator cap. Clean or replace seat
	9. Frozen heat control valve	9. Free up the manifold heat control valve
	10. Dragging brakes	10. Adjust the brakes
	11. Excessive engine idling	11. Set at faster idle or stop engine
	12. Frozen coolant	12. Thaw out cooling system, add anti-freeze as required
	13. Faulty fan drive unit	13. Replace the fan drive unit
	14. Faulty temperature sending unit	14. Replace the sending unit
OVERFLOW LOSS	1. Overfilling	1. Adjust coolant to the correct level
	2. Coolant foaming due to insufficient corrosion inhibitor	2. Flush the radiator and add anti-freeze or rust inhibitor as required
	3. Blown head gasket	3. Replace the head gasket
	4. Broken or shifted lower hose spring	4. Replace lower hose

ing the flow of water from radiator to engine. A worn hose, cracked or split, may leak water. A hardened hose may leak water around the connections. A leaky hose may also allow air to seep into the cooling system, and as the air bubbles form in the cooling system, they may promote rust. The rust, in time, can clog the radiator and the hoses.

In a recent survey, automotive engineers found that 15% of all cooling system complaints were caused by rotted or age-hardened hoses or by hoses with loose, leaking

joints. The trouble may be in the age of the hose, but it can be in the quality of the hose itself.

Hoses are generally made with reinforcement, either an inner layer of fabric or an inner spiral of wire, or—in cases of extreme pressure—both. A hose without some kind of reinforcement can break without warning. In a recent test, engineers checked reinforced hoses against unreinforced types. Of all non-reinforced hoses, 54% failed during the test; only 15% of the reinforced types gave any sign of trouble.

To be safe, check the condition of hoses about every six months. Inspect them for cracks, splits and signs of leaks. Squeeze radiator hoses. Be sure they are springy and resilient, not spongy and lifeless. If any hose collapses under finger pressure and does not instantly spring back, it should be replaced. Hoses which are too hard may leak at the connections. Replace these. If the hoses seem in good condition and your engine still runs a fever, remove the hoses to see if they may be clogged with rust.

Replacing hoses. When you replace a hose, use one with the recommended internal diameter. If there is any doubt about the hose clamps, replace them.

There are many types of clamps used on cars.

The best is a worm-drive type, in which a worm gear engages slots in the clamping band. This band clamp applies the closest thing to circular clamping pressure. (The pressure is actually tangential.)

As a band design, it also has the advantage of not digging deeply into the hose, as the wire-type clamps do. And the greater area under the clamp means that it holds its tightness longer.

You can glue the new hoses to their connections with a thin coating of sealing compound if you wish, but this is not necessary when you use the right clamp. But whether you glue the new hoses to the connections or rely on clamp pressure, be sure to clean the connections before you fit the new hoses.

To replace the upper radiator hose, drain the radiator by opening the petcock at the bottom. Drain only enough liquid from the radiator to lower the coolant below the level of the upper radiator pipe.

To replace the lower radiator hose, drain the entire cooling system. Open both the petcock on the radiator and the petcock on the engine.

To replace the heater hose, check the intake and exhaust levels of the hoses. If they

Maintaining Your Car's Cooling System

take off and empty above the upper radiator pipe, you will have to drain only part of the coolant from the radiator. If they fit to connections below the upper radiator pipe, it may be necessary to drain the entire cooling system to replace them.

After you have drained the system to the safe level (or empty, depending upon the car and the hose to be replaced), loosen the hose clamps and remove the worn hose. If the hose to be replaced is a straight section, you can cut a new length to match. If the hose is premolded, buy one to match. Use the old hose as a pattern. If the hose is a flexible type, be sure you have the right replacement.

Place two clamps over the new hose. Clean the two connections and slip the hose onto the engine connection first. Attach the other end to the radiator connection, bending the hose near the center to fit over the radiator pipe. Tighten the clamp at the engine connection, then slide the hose upward on the radiator connection as far as it will go. Tighten the radiator clamp.

Refill the cooling system with water (or anti-freeze) and start the engine. Check the hose for leaks, then retighten the clamps after the engine has warmed.

Other leaks. If there are traces of rust near any of the headbolts, remove the bolts (after the coolant has been drained) and wire-brush the threads clean. Then apply a film of nonhardening gasket cement to the threads and pull the bolts up to uniform tightness, using a torque wrench, if possible, to make sure the bolts are tightened uniformly. Refer to the engine or wrench manufacturer's specifications for the correct torque in foot-pounds, which may vary between 50 ft./lbs. and 120 ft./lbs., depending on the size of the headbolt.

If an expansion plug in the block is rusted, remove it by driving a sharp center-punch through the plug about $\frac{3}{4}$ -inch near its center and giving the punch a sharp tap sideways with a hammer. Scrape clean the

recess in which the plug fits, using a screwdriver blade. Then drive a new plug into place, after applying a thin film of gasket cement to both the plug and the surface upon which it rests. Strike the domed side (which should always face *out*) a sharp blow with a machinist's hammer to cause plug to expand and form a tight fit in the block.

You will need a new cylinder head gasket if there is any sign of water in the crankcase oil. To check for leakage of exhaust gas into the coolant—and consequently the possibility of the leakage of coolant down into the engine—first remove the top hose from the engine and take out the thermostat. Then fill the engine with water and remove the fan belt. Carefully block all four wheels or set the emergency brake, then put the car into automatic drive. With a conventional transmission, shift into “high” and apply the load by slipping the clutch. Have an assistant start the engine and very quickly, before it has warmed up (which might create steam bubbles), accelerate it very briefly to rather high speed. If there is an exhaust gas leak into the coolant, you will see bubbles in the cooling system water in a matter of seconds. If bubbles appear, a new head gasket is in order. Before installing the gasket, be sure that head and block mating surfaces are clean.

The presence of a white deposit (lime) on the radiator core is a warning that water has leaked out and evaporated.

If you are using an antifreeze with a sealer, the leak is apparently serious, for this type of antifreeze will seal minor leaks. If you are not, try a can of sealer before going to the expense of having the radiator resoldered.

Water pump. If there is any sign of leakage at the water pump joint, try tightening the bolts. If this does not cure the problem, the pump will have to be removed, checked for a defective gasket and replaced if the

gasket is good. (The problem is in the pump shaft seal.)

Note: do not confuse minor seepage from the pump vent hole with a leaking pump. The vent hole is supposed to permit the small amount of coolant that gets past even a good pump seal to drop out.

Radiator cap. The only sure way to test the radiator cap is with a pressure tester, a combination unit that also tests the ability of the cooling system to withstand the pressures built up by the cap.

If the cap holds specified pressure, it then can be physically inspected. The rubber seal should be in good condition. It and the inside of the radiator neck should be wiped clean of rust deposits. The vacuum valve should be checked by hanging a fingernail under it and tugging. It should open easily and spring back when released.

The system itself. Even if a system shows no apparent leaks, it should be tested to see if it will hold at least the pressure of the cap. If the system fails to hold cap pressure, check for loose gaskets and poor hose connections.

A pressure test of cap and system should always be made before draining, flushing and refilling.

Very few weekend mechanics are likely to have a pressure gauge. You will have to pay a service station a service charge for this test.

The anti-freeze and cooling system chemicals committee of the Automotive Division of the Chemical Specialties Manufacturers Association summed up modern practice in a detailed recommendation on cooling system care. The recommendation was distributed to the professionals, and is included here for weekend mechanics.

“The modern engine is designed to maintain efficient operating temperatures year-round with ethylene glycol (permanent antifreeze) solutions. New cars have factory-installed ethylene glycol antifreeze coolant which will afford freezing protec-

tion adequate for most areas of the country and which contains corrosion inhibitors to protect the cooling system. Under recommended service conditions, this antifreeze coolant will function for at least one year." (Goodbye to the semi-annual drain.)

"The antifreeze tester" (that's a hydrometer they're talking about—you can buy one for a dollar, although most of you probably have one already) "has now become a year-round service tool—check in warm weather months as well as winter for solution concentration and appearance. Maintain a minimum concentration providing 34° F.—50 percent—for adequate corrosion resistance and temperature protection."

The temperature protection is not only for winter. Antifreeze also raises the boiling point of the coolant and the entire cooling system is designed for this higher boiling point.

Most cars have temperature warning lights that go on at about 250° F. In a system with pure water and a pressure cap holding to 14 psi, the water would boil at 244°, meaning that you would have an over-heated engine with no warning.

And that would be with a 100 percent sound pressure cap. If your cap were only holding 11 psi, the coolant would boil at 235° with pure water, and 245° even with — 20° F. antifreeze protection.

All cooling systems leak to some degree. A perfectly good system will leak a pint in 1200 miles. If you just add water, the antifreeze concentration will soon drop to the point where over-heating protection is lost.

The new rules on cooling system service are:

1. Drain, flush and refill just once a year, but make sure the refill is at least 50 percent antifreeze. (Never exceed two-thirds antifreeze, as this is the highest percentage that will keep the freezing point down. As the antifreeze percentage is increased from two-thirds, the freezing point

Maintaining Your Car's Cooling System

actually goes up. A 100 percent antifreeze solution will freeze at only — 8° F.)

2. When you top up the cooling system, do so with a 50-50 mixture of antifreeze and water.

Cooling system flushing. If the coolant is speckled with rust particles, you should add a can of flushing compound to the radiator and drive the car for about 100 miles to circulate it properly and give it a chance to work in.

The actual draining of the coolant can be done in either of two ways, but in any case should be preceded by a cooling system check.

1. You can open the drain cock on the radiator and remove the two drain plugs on a V-8 or open the drain cock on a six. Permit the coolant to drain out, run some water through the system, refit the drain plugs, close the drain cock(s) or whatever, and fill the system with a 50-50 antifreeze and water mixture.

This is a perfectly acceptable procedure and it will work nicely. The only problem is that the engine drain plugs on V-8s must be removed from underneath, and even the drain cocks on some sixes are not overly accessible.

You must have some way of safely jacking up the car. (After all, you will be getting underneath, and you don't really trust that bumper jack, do you?)

Even if you have a jacking setup, it is time-consuming to use. Most cooling system drainings are done in the soft earth backyard, not in the garage with its concrete floor. This can make the jacking somewhat difficult if not impossible.

2. You can use the flush and fill procedure illustrated. Although designed for use with an air pressure flushing gun, it will work acceptably with a garden hose.

3. You can install a flushing kit, an inexpensive set that includes the deflection elbow and a plastic tee that is installed in the heater hose. (The only tools necessary to

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▲ Inexpensive kit for flushing an automobile cooling system.

▼ Water deflector of kit is fitted to radiator neck. This prevents flushing water from splashing into the engine compartment.



▲ Kit's permanent tee-fitting is installed in heater hose.



▲ Threaded tee of kit accepts garden hose for flushing. When job is finished, cap of tee is screwed on tightly.

install are a saw to cut the heater hose and a screwdriver for the hose clamps.)

The tee-fitting has a screw cap that is removed and a garden hose attached when you want to flush the system. Just turn on the water and the flushing procedure is essentially the same as with the illustrated procedure for the flushing gun.

See also: ENGINE.



How to Make Decorative Plaques

**You can turn simple,
inexpensive materials—yarn,
for example, or
felt—into handsome decorations
for your walls**

YOU CAN USE SIMPLE, inexpensive materials to make handsome wall hangings. The ones pictured here were made of plywood, felt, burlap, glue, nails, paint, yarn and a few buttons and artificial flowers. Let them serve as guides when you design and make your own decorative hangings.

For a plaque like the one of Raggedy Ann or Andy, start with a piece of Masonite or 1/4-inch plywood 18 x 24 inches and a

piece of closely woven light colored burlap, linen or desert cloth. Cut the cloth somewhat larger than the board so the edges will roll over the back.

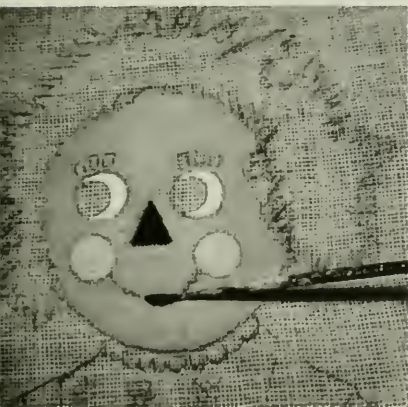
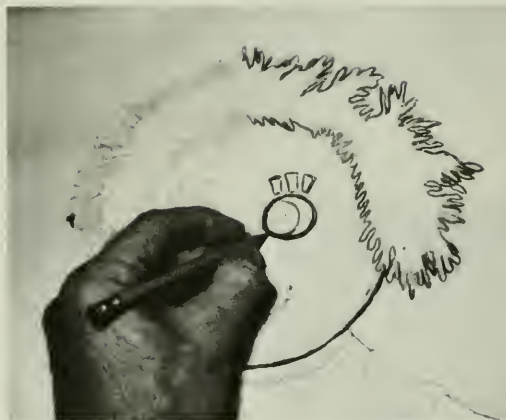
Use thin white glue to attach the fabric to the face of the board. Turn the board over and glue the extra fabric to the back of the board, mitering the corners. Hold the fabric firmly in place with cellophane tape until the glue is thoroughly dry.

How to Make Decorative Plaques

➤ Use thin coat of white glue to attach fabric to board. Fold the edges over, glue them to the back and hold them down with cellophane tape while they dry.



➤ Trace the design with firm, steady pressure on the pencil; but don't push so hard that the pencil tears through the paper.



◀ When painting, start with the lightest portion—a small touch of yellow and one of red added to white will make a suitable flesh tone—and work toward the darker colors.

When the glue is dry, cover the surface of the plaque with carbon paper, carbon side down, and tape your design over it. Use any design you like. It could be Raggedy Ann or Andy, both available from a



▲ Use white glue to paste down lengths of colored yarn.



▲ Applying the finishing touches. Major portions of design have been outlined in black, but details, such as flowers, do not require this.

How to Make Decorative Plaques

mail order house, or it could be a print, poster, or clipping from a magazine. Choose one in which the design is formed by distinct masses of color and avoid shading and fine detail.

Trace the design with a dull pencil. The pencil will leave a mark, letting you know where you have already traced, and the dull point will be less likely to punch through the weave of the fabric than a sharp one. When you have finished going over the design, remove it and the carbon paper and you will find the tracing on the fabric.

In the Raggedy Ann and Andy plaques, the hair is made of varying lengths of yarn and the balance of the design is painted. But you could paint the whole design, or fill it all in with yarn of different lengths and colors, or any combination you might choose. Or you could use scraps of felt, or fabric. The choice is yours.

If you use paint, use casein or tempera, both available in art supply stores, as are the artist bristle brushes for applying it. You'll need three brushes, a fine, a medium and a broad of the same kind used in oil painting. Casein paint is somewhat more expensive than tempera but it is more durable.

When painting, fill in the lightest areas first and work toward the dark colors. If you wish to outline the drawing, do it with black paint and a fine brush.

In the plaques here, the finishing touches are Raggedy Ann and Andy's buttons, which are real buttons, and Andy's bouquet, which is made of paper flowers wired together and held with a brad nailed through the fabric into the plywood.

Another technique you can apply to your plaques is the use of nails and yarn. The two examples here show a balloon, made of felt, nails and yarn and accented with a Snoopy figure cut from a greeting card, and an owl accented with a stick of gnarled driftwood.

How to Make Decorative Plaques

▲ To attach felt to board, fold edges over back of board, pull them tight and glue them down with white glue, holding them in place until the glue is dry.

➤ Make tissue paper patterns of both the shapes you want to cut out of felt and of your nailing design. Tape down the nailing pattern over the felt and drive the nails through it.



The two examples illustrate the range of possible effects that can be achieved by varying the felt background, the nail pattern and the types and textures of yarn.

If you are going to use nails, use $\frac{1}{2}$ - and $\frac{3}{4}$ -inch plywood, rather than $\frac{1}{4}$ -inch, and just drive the nails in deep enough for them to stand firm. Part of the appeal of this technique is that the yarn is raised from the surface of the plaque. Choose $1\frac{1}{8}$ -inch

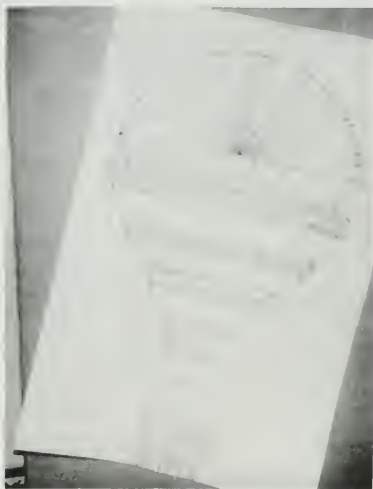
plywood finishing nails, which have ribbed bodies and a cap-like head. Sometimes, these nails are available in colors. If not, use them in their natural silvery finish or spray-paint them.

Planning the pattern for the nails is the most difficult part of this kind of project. Before you start, make an extra tracing or two and use it to plan the areas or outlines you want to decorate with yarn and sketch

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in the nail points and runs of yarn from one point to another. Keep at it until you have the design you want.

Frames for your plaques are available in many standard sizes, pre-cut and pre-assembled. For example ready-made



▲ Drive each nail in straight up. Keep the pattern in place while the yarn is being looped and tied in place on the nails. When the work is completed, tear the pattern out from under the yarn in small pieces.

How to Make Decorative Plaques



▲ Applying the yarn. Bouclé is used here, but the type of yarn you choose can be varied according to the design.

frames for the 18 x 24-inch Raggedy Ann and Andy plaques are widely available in a multitude of types. Also available are do-it-yourself metal and wood frame kits for rectangles of any dimensions that measure out in even inches, so avoid fractions when cutting your plywood.

Original designs by Steve Ellingson.

See also: PICTURE FRAMING.





Make Toys and Jewelry Flash

You can delight children with toys, pins or pendants that blink. All you need are tiny light-emitting diodes, a simple electronics circuit and a battery

HERE'S AN INTERESTING application for the light emitting diode (LED). Because of fast turn-on time and long life, they are used mostly in digital equipment as indicators or card readers. These tiny red or green dots of electronic light can be used in simple circuits for toys, jewelry, or other eye catching objects. Here are some ideas for easy-to-build electronic circuits with a tricky twist or two that show off your handiwork.

Lady's handbag. The easy way to start is to have lots of room for the electronics and battery. The small metal cat (under

\$2) gets two LEDs implanted as eyes. The simple circuit makes the eyes blink. Secured to the side of a handbag with epoxy, only the cat is seen while the electronics are hidden inside.

Toy fire truck. Any small model car can be wired up with a pair of LEDs in place of the headlights, stoplights or—as in this case—under a small red beacon. Choose a car big enough to hide the battery and the circuit, but not too large to lose the scale of the small LED's.

The owl. To make a brooch or other small jewelry takes more skill and some patience. The owl is hardly a masterpiece, but it is unusual since everyday owls have yellow eyes and this one has red. The problem was where to put the batteries. More expensive camera type disk batteries could be used. Some cells are too bulky to hide behind the brooch, so the owl had to sit on a tree with the whole thing hanging from a chain instead of just being pinned on.

To construct the perched owl, a two-inch



▲ This inexpensive owl pin was fitted with flashing eyes made of light-emitting diodes. The owl was glued to a piece of driftwood with epoxy adhesive. The driftwood provides space for batteries and electronic circuit.



Make Toys and Jewelry Flash

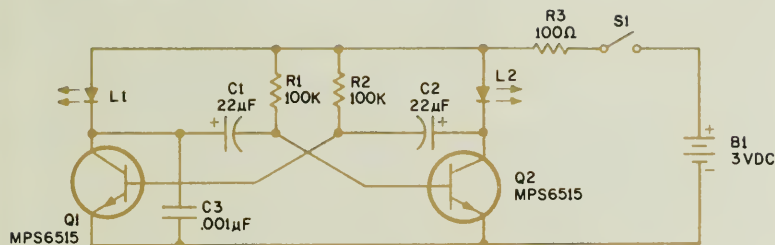
piece of driftwood was hollowed out, then cut lengthwise and glued on the owl. The log contains the batteries and electronics hidden by a covering of black felt material on the back. The felt is held in place with a rubber cement so it can be easily removed to change the battery. There was no place left for a switch, so two small wires have to be twisted together to start the owl blinking. Readers who like this idea can find many better ways to make blinking jewelry a new handicraft.

The electronics. There's an astable multi-vibrator to control flashing that consists of very few components. Two LEDs are used instead of the collector load resistors. You should include a 0.001 μ F capacitor to eliminate unwanted HF oscillations if long wires are used for the LED's (the eyes.) On the other hand, if this capacitor is omitted, the blinking is more random, creating a special effect.



◀ Small cat was attached to handbag. The switch, battery and electronic circuit for the blinking eyes are in the handbag. ▲

Make Toys and Jewelry Flash



Build the circuit on a small piece of perf-board. Then try to change the value of the electrolytic capacitors and/or resistors. Finally, disconnect C3 and see what happens. During construction and testing, always connect the LEDs with the same length of wire that will be used in the final version. After the circuit works to your specifications, try to make it as small as possible even by omitting the perf-board. Use stiff wires and tape or glue to avoid shorts.

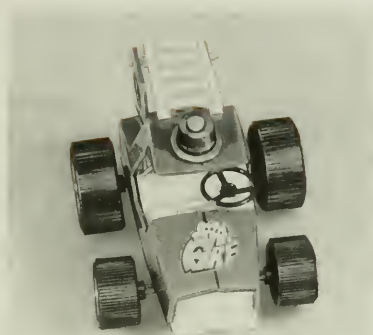
Almost all NPN transistors can be used with a minimum beta of 150. The handbag is easy. Try the other ideas only if time and patience are no problem. Some little or big girl's eyes will light up, if not blink, for a special gift like this.

I.G.

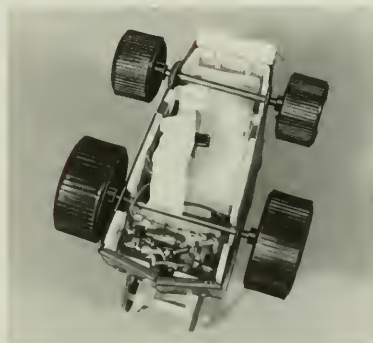
See also: ELECTRONICS.

PARTS LIST

B1	3-V A cells (2)
C1, C2	22 μ F, 3 to 6 VDC electrolytic capacitor (try values from 20 to 60 μ F)
C3	.001 μ F, 30-V disc capacitor
L1, L2	Light emitting diode (HEP-P2000 or Motorola MLED600 which are large red plastic units that light red; or HEP-P2001 or MLED-50 which are small clear plastic units that light red)
Q1, Q2	Transistor, audio NPN (Motorola MPS6515, HEP-728 or equivalent)
R1, R2	100,000-ohm, $\frac{1}{2}$ -watt resistor
R3	100-ohm, $\frac{1}{2}$ -watt resistor
S1	Slide or toggle miniature switch SPST
Misc.	Battery holder, hookup wire, solder, epoxy glue, etc.



▲ Small toys are a good place to insert flashing lights. In this toy fire truck the light-emitting diode is placed in the flasher on top of the cab. Upside down view shows the switch and battery in the midsection and the electronic circuit aft of the axle. ▼





Wilderness Craftsmanship

How to use sticks, wire and twine to improvise anything from kitchen gadgets to emergency shelter

PROBABLY NOTHING in the world of nature has been put to more varied uses than the ordinary stick. Sticks are one of nature's raw materials for those who want to fashion their own camp equipment. Look, for example, at the wilderness kitchen.

Driven into the ground on the sides of the fireplace are two stout forked sticks. Across them is another stick. This is a spit. The grouse tied to it can be easily turned over the bed of coals.

For other meals the stick is raised to higher forks on the uprights. Hanging from it now are pothooks made by lashing together two opposing forks from tough, green wood. Use wire for the lashing; string could burn and let your soup fall into the fire.

And there is a hook made of a single inverted crotch. In the lower arm of the hook are notches cut to take the bail of the stew pot.

To one side of the fireplace is driven another forked stick. It holds the center of a longer stick, one end of which sticks in the ground while the high end supports the coffee pot in simmering position.

For broiling steak the cook has cut another forked green stick with long tines. He brought one end around the other to form

crappies: see fishing

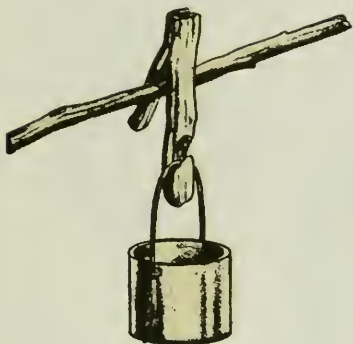
crate furniture: see lumber

crown molding: see moldings

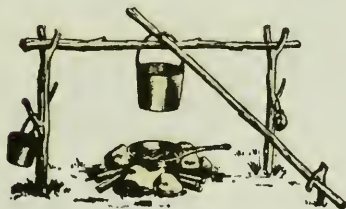
crulser: see boat building projects

crystal: see electronics

Wilderness Craftsmanship



▲ By notching a green limb, you can convert it into a very practical pot holder.

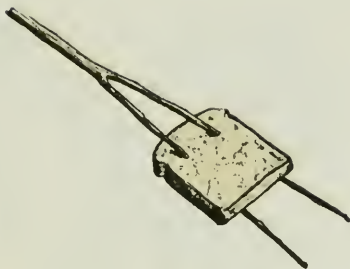


▲ A simple fireplace can be made with green limbs and stones from around camping area.

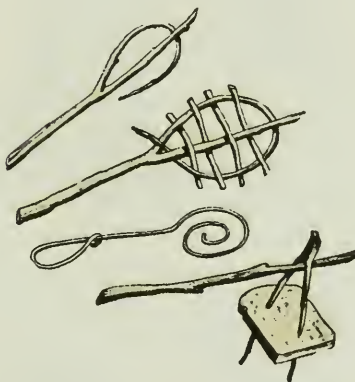


▲ Make a tin can stove by punching holes for draft with a can opener or hunting knife.

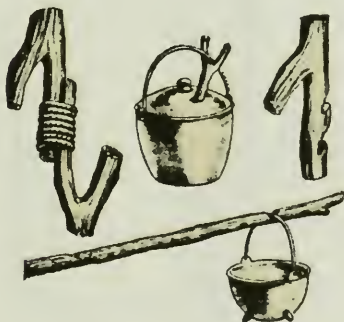
➤ It doesn't take too long to find these pot hooks and holders around your camp.



▲ A handy way to toast bread or franks is to skewer them on the end of a forked limb.



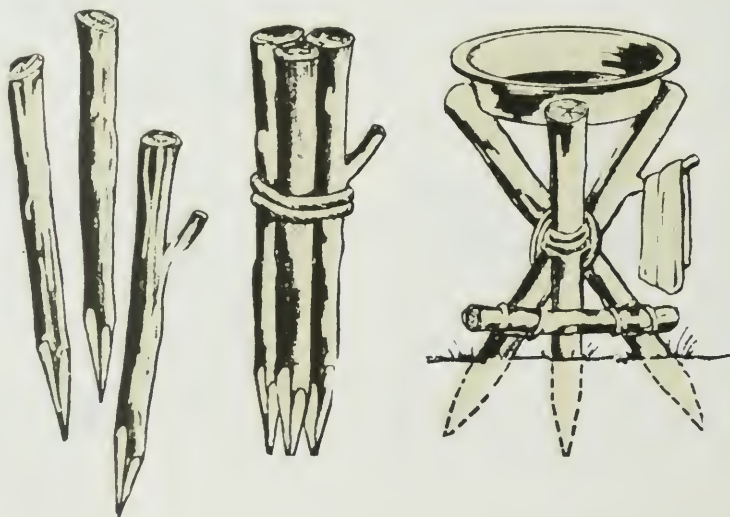
▲ Broilers and sticks for toasting can be made out of green limbs or lengths of wire.

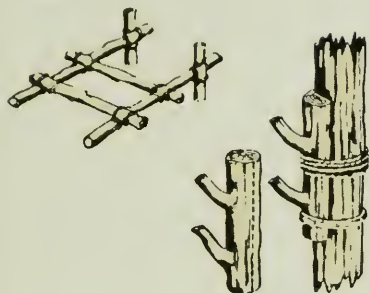




▲ Twig for a whip; bandana for pot holder; soap smeared on kettle for easier cleaning.

▼ Tripod basin rack can be made by using a sheer-type lashing to hold sticks together.

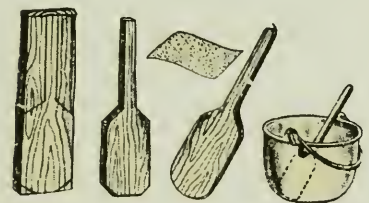




▲ Practice good housekeeping by making a rack that is raised in the back with two pegs.



▲ Layers of different size stone help filter out the dishwater and prevent water pollution.

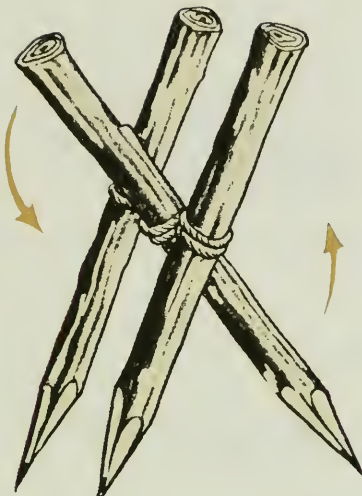


▲ Cooking paddle can be made from scrap lumber. Smooth broad bottom with sandpaper.

a loop with a center brace and weaves cross-pieces into it to hold the meat.

Somewhere nearby he has another stick, the simplest cooking aid of all. It is whittled to a point on one end for toasting bread, or can be used as a skewer for shish kebab—alternate chunks of meat and vegetables broiled over the open fire.

In an emergency most any green stick



▲ Another way to make a tripod is to bind three sticks together and twist the middle pole.

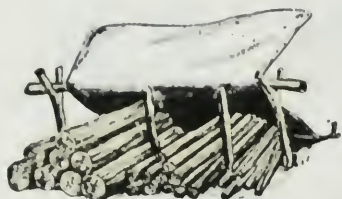
will do for such broiling. But given a choice some serve better than others. The resinous evergreen branches are not the best. A few woods, including ash and birch, will burn even if they are green. Some other choice would be better.

You can try using wooden crosspieces on which to rest the bottom of stew pots. Then, it is even more important to choose a green hardwood that will not burn easily. This is a risky procedure which may end in a spilled dinner. It is better to support the pans or skillet on rocks or suspend them from the handles.

Having completed the wilderness kitchen you can find many other ways to improve your camp with what is around you.

On marshy ground a platform of sticks can hold your bed out of the water.

A long stick becomes the ridgepole for an emergency shelter. Lean it from ground to a tree or some other support then place



▲ Pegs driven into the ground under cross-pole hold the canvas up for ventilation.



▲ Two forked sticks with a green pole lying in the forks are all you need for a broiler.



▲ Simple shelter frame made by draping a tarp or pine boughs over tripods and poles.

➤ Make a handy broiling slab for fish and other wildlife by driving nails into hardwood.

Wilderness Craftsmanship

ribs along one or both sides of it in an inverted V-form. This becomes a frame for your tarp or for a roof made of evergreen boughs.

If you're short on food and ways to get it, sticks become fishing poles, spears and clubs.

Prop up a rock or log to fashion a dead-fall trap, or bend a sapling over to hold the loop of a snare set across a game trail. You might even fashion a small piece of tough wood into a fish hook. Primitive man did and made it work.

For the injured a forked stick becomes a wilderness crutch, or the splint to bind a broken bone.

For the one who doesn't want to get injured it becomes a tool for exploring unknown depths of snowbanks or stream bottoms.

And if you have some materials with which to tie two or more sticks together a whole new fascinating world of outdoor invention opens up to you. Many outdoorsmen find that a spool of copper wire is a handy item to carry with them because it doesn't take up too much room in the pack or pocket, can be conveniently rewound when it's time to break camp, and holds its shape even in changing weather conditions. Another compact item that offers about the same advantages is fishing line.

See also: CAMPING; CAMPING EQUIPMENT; HIKING.



Dress Up Your House with a Cupola

**This decorative piece is
also functional. It ventilates
the space beneath
a gable roof**

HERE'S A CUPOLA that will not only add to the architectural styling of your home but also serve as originally intended—to ventilate and provide an escape for air trapped under a gable roof.

Start construction with the four corner posts. Using clear, straight-grained white pine, lay out and saw the grooves for the louvers in two sides of the posts with a $\frac{3}{8}$ -inch wide dado head in the circular saw. Set the miter gage at 45° when sawing. Cut 32 louvers. Make the four base pieces next, determining the V-shaped cutout from the pitch on the roof.

Assemble the parts made thus far, by fastening two corner posts to each base piece having the V-shaped cutouts, with three #8 x $1\frac{1}{2}$ inch flat head screws. Temporarily place two of the louvers in the grooves between the two posts to get the correct spacing before fastening to the base pieces.

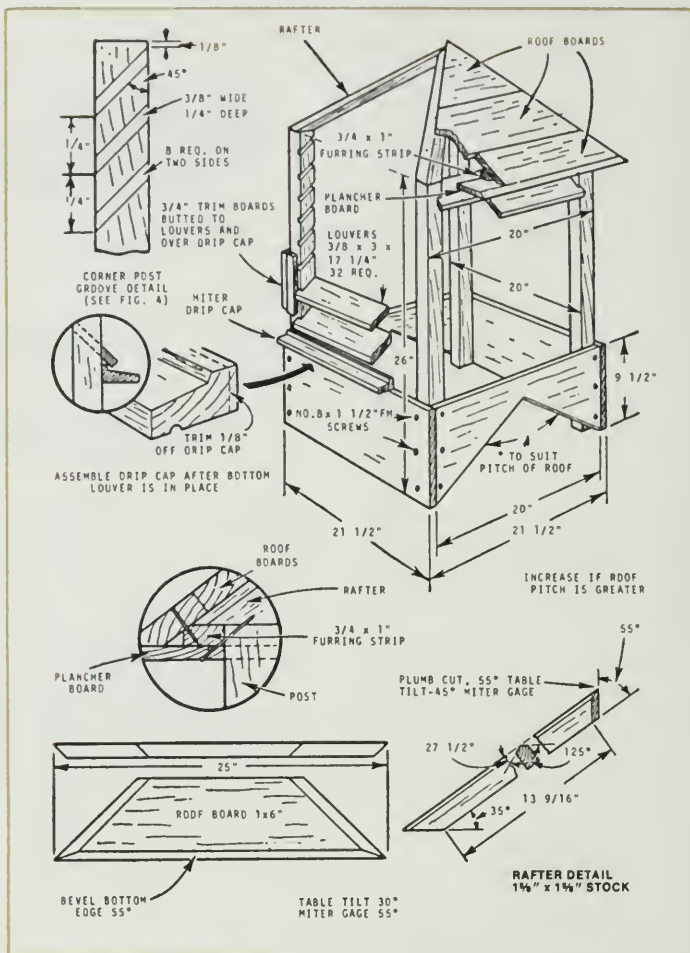
Trim $\frac{1}{8}$ -inch off a 12-foot length of stock-size drip cap, measure and miter cut the ends and fasten to the top edge of the base. Set the louvers in the grooves and toe

nail in place. Now, assemble the two ends together by again temporarily placing two louvers between the posts on each side for spacers. Fasten the ends together with the other two base boards and three #8 x $1\frac{1}{2}$ inch flat head screws. Measure and miter cut the ends of the drip caps but do not nail to the top edge of the base boards until the bottom louvers are in place. Insert the rest of the louvers in the grooves and toe nail in place.

Cut the roof rafters from 2x2-inch stock ($1\frac{5}{8}$ x $1\frac{5}{8}$ -inch) and saw the angle cuts on a circular saw. Make the plumb cuts where the roof comes to a peak by tilting the saw arbor or table 45° and the miter gage to 55° . Double bevel the top sides $27\frac{1}{2}^\circ$ and assemble to the four posts with the rafters extending $\frac{1}{2}$ -inch beyond the posts. Nail the $\frac{3}{4}$ x 1-inch furring strips in place and bevel the top outer corner to same angle as rafters.

Start covering the roof rafters by cutting and fitting the beveled edges on the long 1 x 6-inch bottom roof boards first. Then work toward the peak, beveling the ends at

curbs: see stonework
currents: see navigation
dadoes: see woodworking
daffodils: see flowering bulbs
dahlias: see garden planning



the same angle as the long ones. Nail all roof boards in place and finish under the eaves with $\frac{3}{8}$ x 3-inch plancher boards mitered at the ends. Plane the outer top edges of the plancher boards to the same angle as the roof boards. Finish by nailing

$\frac{3}{4}$ -inch thick trim boards to the outsides of the posts and saw off the bottoms of the posts at the same angle as the base boards.

If you intend to add a weathervane now or at some later date, drill a $\frac{1}{2}$ -inch hole through the peak and add a 2 x 2-inch

Dress Up Your House with a Cupola

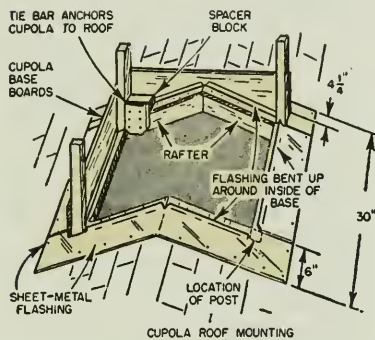
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brace diagonally across the posts inside near the top. Paint the cupola with one coat of outside white primer and follow with a finish coat of house paint of a color that will harmonize with the rest of the house. For shingles, use the same color and type of roofing material as on the roof of your home. Make them 6 x 11 inches in size and lay with 5 inches exposed. Make the cap shingles for the corners 4 x 6½ inches in size. Be sure to tack window screening over the louvers on the inside.

Assuming that you are putting up your cupola on a finished roof and after deciding where you wish to locate it, mark off an opening with chalk 18 inches square between two rafters. If your rafters happen to be 16-inch on centers, cut the opening 14 x 18 inches. This will still allow adequate ventilation. Remove the roof cap for approximately 36 inches. Then with a linoleum knife, or other sharp tool, cut the shingles on the chalk line and with a key-hole saw cut out the roof boards. If there is a ridge pole, leave it intact. Lay four pieces of metal flashing around the opening and nail in place. Seal the underside of

the flashing with mastic as a precaution against a beating rain. The cupola can be fastened to the roof boards by toe nailing through the flashing, or tie bars and spacer blocks fastened to the cupola and roof rafters at each corner can be used. After nailing the cupola in place, bend up the flashing on the inside. Then replace the roof cap so that it butts up against the cupola on both sides.

See also: COOLING; HOME IMPROVEMENT.



MATERIALS LIST

Quantity	Size and Description	Purpose
4	1½" 1½"x26" white pine	posts
2	¾" 9½"x21½" pine	base
2	¾" 9½"x20" pine	base
32	¾" 3"x17¼" pine	louvers
4	1½" 1½"x30" pine	rafters
2	1" 6"x10" pine	roof boards
4	¾" 1½"x16" pine	trim
4	¾" 2½"x16" pine	trim
4	¾" 1"x22" pine	furring strip
4	¾" 3"x27" pine	plancher board
1	stock size drip cap 12' long	drip cap
as needed	#8 1½" flat head screws	base

NOTE: Also need, nails, paint, screening and roofing material.

Build This Inexpensive Darkroom

You can fit sufficient working area and equipment for most darkroom jobs into about 25 square feet of floor space. The cost: less than \$100



AMATEUR PHOTOGRAPHERS often have to take their darkrooms as they find them—hastily set up and dismantled in bathrooms or kitchens, for example—but if you've got about \$100 to spend and about 25 square feet of space you can design and build a permanent darkroom suitable for most photographic operations. The cost, of course, does not include the price of photographic equipment.

It has working space for an enlarger, timer, developing trays and print trimmer, a conveniently-located central control panel, fitted storage for accessories, a filtered air inlet and fan exhaust, a built-in paper safe, running water, a built-in print washer and adequate storage space. The cost, exclusive of photographic equipment, is about \$70 to \$100 for materials, even if you have to buy everything new.

Planning. Any construction project as permanent as a darkroom deserves some preliminary skull-work before the cutting and nailing begins. Good planning can save time and wasted materials and guarantees a darkroom that suits your needs.

A good way to begin is to list the equip-

ment which will be housed and used. The basic piece of equipment is the enlarger. If you require a contact printer as well as the enlarger, a good place for it is in the table beneath the enlarger, with the ground glass flush with the table surface. These two units will usually be permanently mounted and require no additional storage space.

You will need working space for the developing trays you normally use, and for storing them. You may want space to use and store a paper cutter. Storage space will be needed for enlarging easels, paper, chemicals, negatives, print tongs, dodging tools and the print dryer. You may also wish to provide shelves for reference books, a radio and for storage of camera gear.

Generally speaking, storage space will not be the prime consideration in deciding darkroom size. Rather, working space required will decide the practical minimum room size and the necessary storage can then be designed beneath the working surface or overhead.

It is important to plan work-level space for all of the equipment needed for a

Build This Inexpensive Darkroom

single operation, at least. For example, the enlarger, developing trays, print washer and perhaps a trimmer will be required for enlarging and developing pictures. A layout which requires you to stop in the middle of an operation and rearrange equipment will be a constant source of annoyance.

Templates, cut to scale, offer a good way to determine your basic layout. However, if you have trouble visualizing a layout this way, block off the space with chairs, a ladder or length of rope and mount your equipment in approximate position on boxes or whatever is available. When you have found a workable layout, take measurements and sketch it on paper.

Size. If you have unlimited space available, size will obviously be no problem. Most readers, however, will need to plan for a minimum-space darkroom such as the one pictured. About 20 square feet of floor space is the bare minimum. The room pictured is a little larger, 25 square feet. (The average bedroom closet measures 16 square feet.)

The room is designed for stand-up working; however, a high stool can be used. The shape of the floor space available will have some bearing on how much square footage you need. Because of the nature of the operation, a rectangular floor space is easier to lay out efficiently than a square one, when working with minimum space.

In the average house, the question of darkroom location may not leave much room for choice. The one illustrated could have been built in either of two locations. The site finally selected had easy access to water and drain lines, but interfered with an outside door. The equipment was arranged to permit cutting off one corner of the room without loss of needed working space.

Wet or dry? Perhaps the knottiest problem is whether to pipe in water for a "wet" darkroom or to work "dry," depending upon sink facilities outside the room. The

solution to this question will depend upon several things: access to existing water and drain lines for tapping in; space available for a sink in the planned darkroom; and cost.

If you are forced to select a location for your darkroom where water and drain lines are not accessible, it may be prohibitively expensive to provide water inside the room. If, on the other hand, your darkroom will back up against a wall containing water and drain lines, and if you are willing to apply some ingenuity in use of materials, a "wet" darkroom will cost very little more than one without the convenience of running water.

If water is within easy reach outside, however, this is not as great a disadvantage as might be expected. Much film developing today is done by tank which, once loaded, may be carried to the nearest sink to complete the operation. For printing or enlarging, the final tray in a "dry" darkroom may be a first rinse large enough to hold two dozen or more prints. Periodically this is emptied into the print washer located in the nearest sink or laundry tray. Clean-up, of course, is done at the sink, if running water is not available in the darkroom.

Finally, in deciding the "wet" or "dry" question, you will have to consider the working space available for a sink. This need not be large, but if the space available is very tight, a "dry" darkroom with adequate work space is preferable to a "wet" but overcrowded one.

Layout. Most space-consuming of the darkroom operations is printing or enlarging. These are sequence-type operations which begin with exposure of the paper, development, shortstop or rinse, fix and finally wash. If you are right-handed, the layout shown is convenient and requires a minimum of floor space.

Note that placement of the door in the center of one side wall permits the maximum of table area, if you are working with

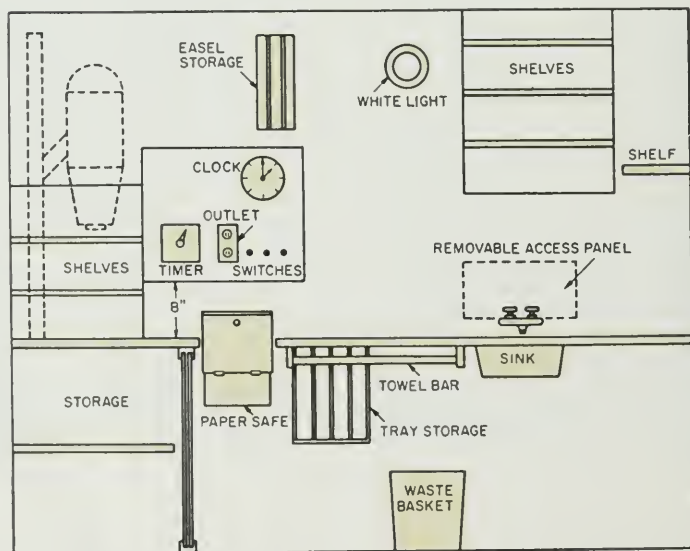
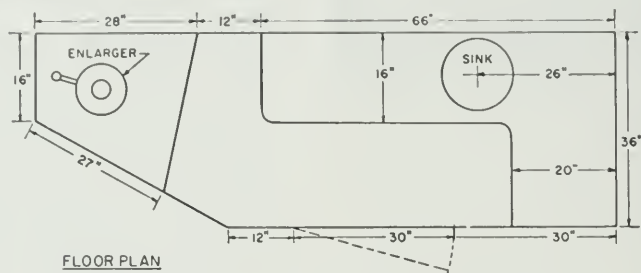
minimum floor space. Grouping of the timer and switches on the wall to the right of the enlarger (left, for southpaws) serves a double purpose: all controls are conveniently at hand in fixed locations which are easy to find in dim light, and the wall-mounting doesn't clutter up valuable table work-space.

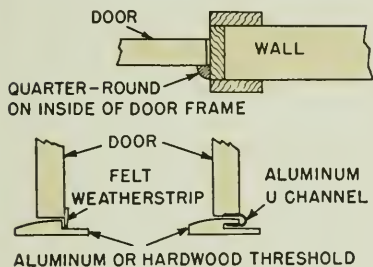
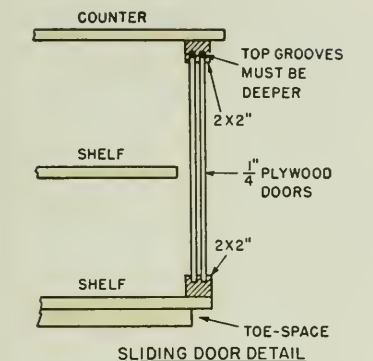
The largest single block of storage space available will be under the enlarger table. Shelves and sliding doors here will house such bulky items as printing and enlarging paper and dry or mixed chemicals. Storage for easels, masks and other enlarging equip-

ment should be a short grab from your normal working position at the table.

Tray storage and a towel bar occupy space beneath the counter where the trays are used. In a minimum-space darkroom, the print dryer will be used outside the room, stored on the floor when not in use.

Construction. Your basic purpose in walling in the darkroom is to keep out light. This does not require heavy construction, although in some cases (such as a darkroom built in unheated space) heavier construction may be advisable for insulating or other purposes. The darkroom pictured





is framed with 2x2 studs and enclosed with $\frac{1}{4}$ -inch good-one-side interior plywood. Gypsum wallboard or any of the insulating boards now on the market are equally good and just as inexpensive.

Used lumber, crating or almost anything else available will be adequate for furring down the ceiling, if required, and for framing the work table and storage shelves, since these surfaces are covered and hidden when finished.

Sliding doors of $\frac{1}{4}$ -inch plywood for the storage cabinets are inexpensive, serviceable and require no particular skill to fit.

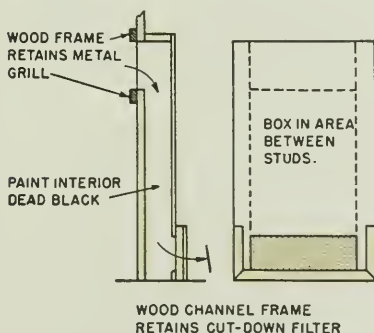
Asphalt tile is the least expensive durable covering for floor and work table and is easy to fit and lay.

Begin construction by laying out the room outline on the floor in chalk. Rough in the plumbing, if required, and run the electrical wiring. Don't stint on the number of outlets; it costs only a few cents more to have an outlet where you need it, once the basic circuit is installed. You will need #12 wire or bx cable (check your local code) with ground wire for this circuit.

When the plumbing and wiring are roughed in, frame the storage cabinets and working surfaces. Nail up the wall panels last. In this way, you will not be forced to work in cramped space to finish the interior details.

Both the door edge and jamb must be painted with flat black paint to prevent light from reflecting through. This light seal depends upon the door closing tightly and evenly all the way around. Use three spring-loaded screen door latches, equally spaced. This type of latch will also permit you to open the door from inside with hands loaded by simply backing against it. The door shown is an old screen door with the screen replaced by panels or $\frac{1}{4}$ -inch plywood. An aluminum or hardwood threshold will also be required, to make the bottom of the door light-tight.

Ventilation. Install a filtered air inlet and fan exhaust, both of which are advisable



AIR INLET

for comfort in a small darkroom. Since the amount of air to be changed is small, any fan available will give adequate ventilation. The air filter is cut down from a standard furnace fiberglass filter. The cardboard frame may be reassembled with transparent tape.

Heat is provided, when necessary, by a small plug-in electric heater on the floor beneath the work table.

Print washer. The combination darkroom sink and print washer was made from a plastic dishpan and the faucets came off an ancient leg-type bathtub. For use as a sink, the pan must be fitted with a drain by cutting a hole in the bottom and inserting a standard lavatory drain. The drain pipe will have holes below the top flange

which receive the overflow on a standard lavatory sink. These must be covered by a sleeve cut from semi-rigid plastic pipe. Rubber gaskets at either end assure a water tight seal.

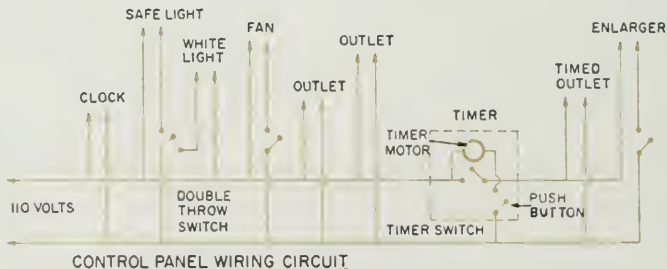
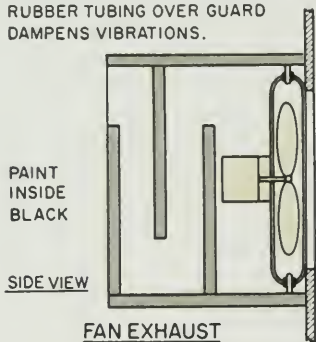
For print-washer use, a drain is required which will draw the heavy, hypo-laden water from the bottom of the pan while still maintaining a water level sufficient for washing. This is accomplished by cementing a length of smaller plastic pipe to the side of the spacer tee on the drain and connecting it to a second outlet in the bottom of the pan.

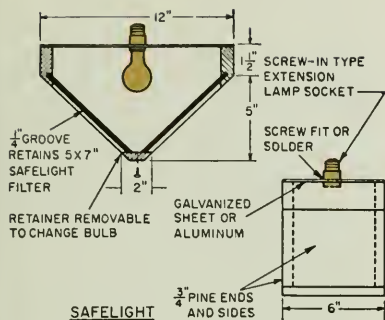
A loop of pipe up the side of the pan prevents water from overflowing until the proper level for washing is reached. When washing prints, the sink drain is plugged. Water enters a length of hose attached to the faucet, which also serves as an agitator, and leaves by way of the overflow. Plastic pipe, and the required cement, are available wherever plumbing supplies are sold.

Enlarger mount. The enlarger is removed from its base and permanently mounted to the table. Pass the power cord through the support column to the underside of the table and permanently wire it into the control panel.

Control panel. From left to right, the controls are: timer, outlet (connected to timer for timing contact printer), enlarger switch, ventilating fan switch and light switch. A double-throw, center-off switch is wired to turn on the white light in the

FAN SUPPORTED BY SCREWEYES.
RUBBER TUBING OVER GUARD
DAMPENS VIBRATIONS.





down position and safelight in the up position. The clock is mounted at eye level and may be read under safelight without a lighted dial.

One safelight mounted on the ceiling is adequate for a darkroom of this size. For larger rooms, two safelights are advisable for better coverage of the work area.

Safelight. The light uses two standard 5x7 safelight filters (Wratten Series OA or equivalent) and screws into an ordinary ceiling receptacle. The bulb may be changed by simply removing two screws and sliding out one of the filter glasses. A top of galvanized sheet metal or aluminum passes off heat without permitting light leakage.

Paper safe. The light-tight paper safe will hold working quantities of three sizes of printing or enlarging paper in four grades each. It is designed to mount on the wall, to save table space.

Film drying. A wire stretched tightly between two screw eyes set in the ceiling over the sink serves as a hanger for film clips.

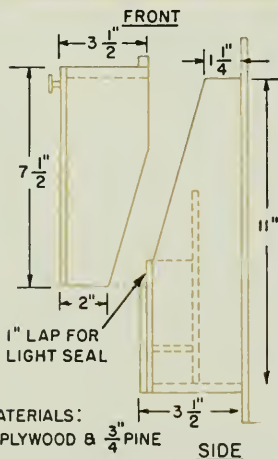
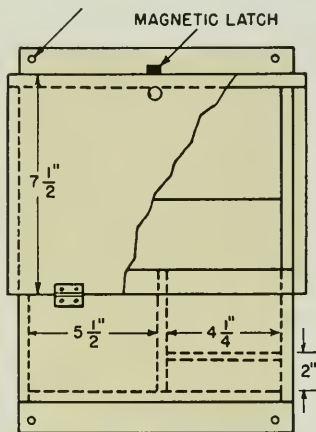
Finishing your darkroom. Paint the interior walls of the darkroom with ordinary rubber-base flat wall paint in a light color. This makes the dim light of the safelight much more effective. Enamel the cabinets.

One final check is in order before you unroll your prize film; go inside the darkroom in broad daylight, close the door, turn out the lights and wait until your eyes

have adjusted to the darkness. Then search out any stray light leaks and mark them for correction. Ordinary caulking compound is a good material for plugging small holes and light leaks in locations that are difficult to reach.

M.C.A.

See also: PHOTOGRAPHY.



Make Your Own Safelight

You can cut costs by building this essential piece of darkroom equipment yourself

ANY PROFESSIONAL photographer will tell you that a key accessory in his darkroom is a good safelight. It must filter properly, so as not to fog light-sensitive paper or film, yet be large enough to provide the necessary illumination.

The price of most large safelights on the market is stiff enough to make many amateurs shudder. But with an 8 x 10-inch safelight filter—which sells for only about \$5 or less in photo shops—and less than a dollar's worth of other materials you can build a simple box-type safelight in a few hours.

Make the box sides and ends from 1/2-inch A-D grade interior plywood. Smear the edges of the end pieces liberally with glue (which will help make a light-tight seal) and nail the sides and ends together, making sure that the edges butt squarely.

Next, drill a 3/8-inch hole in the center of one end of the box, 2 1/2 inches down from the upper edge. Cut a 2 x 2-inch spacer block from 3/4-inch pine and drill a 3/8-inch hole through its center. Glue the spacer block inside the box so that the holes line up.

Now cut lengths of 1/4 x 1/4-inch pine for battens to support the filter. Glue and nail two 8 1/4-inch pieces across the inside

of each end of the box. They should fit snugly and flush with the bottom. Install two 9 9/16-inch pieces along the sides in the same way.

Attach a length of power cord to a threaded base socket and run it through a 2-inch length of 3/8-inch diameter threaded lamp conduit. Screw the conduit into the socket and secure it with the small set-screw in the base. Thread the conduit through the hole in the box and fasten it with a flat washer and hex head nut. Then fit a feed-through on-off switch and plug to the cord.

Figure out how far down from the ceiling you want your safelight to hang and cut two lengths of stopper chain accordingly. Drill holes for 1/2-inch screw eyes at each corner of the box, about 1/2-inch down from the top. Pry open the eyes slightly and screw them into the holes. Fit the end links of the chains over the screw eyes and then crimp the eyes closed again.

Now cut the two pieces for the top from 1/4-inch plywood and glue and nail them together. To position them accurately, fit the smaller piece inside the top of the box, then turn the whole box over and place it on top of the larger piece.

A coat of flat black paint will finish off the exterior of your safelight, and several coats of aluminum paint on the inside will increase its reflecting ability. Finally, slip the filter glass in, screw in a 30-watt frosted bulb, refit the top, and all that remains is to hang the lamp for use.

See also: PHOTOGRAPHY.

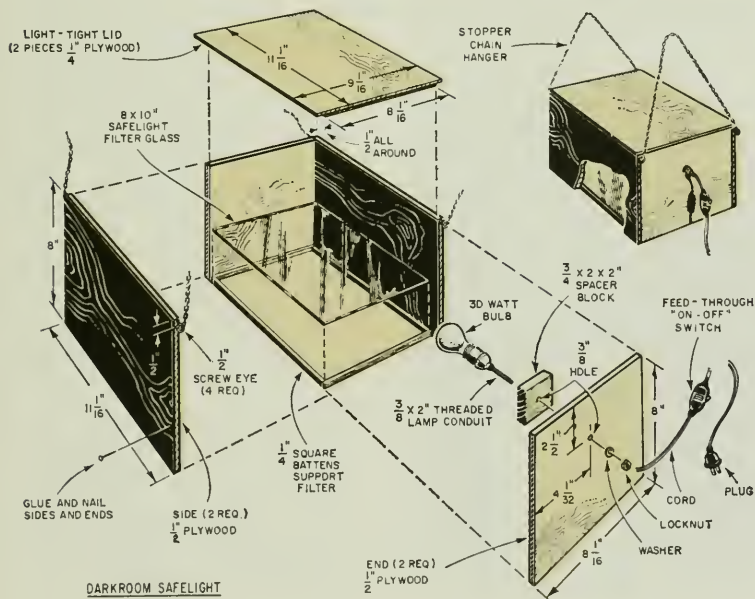
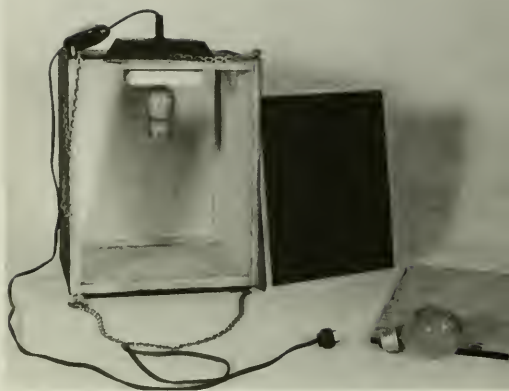
Make Your Own Safelight

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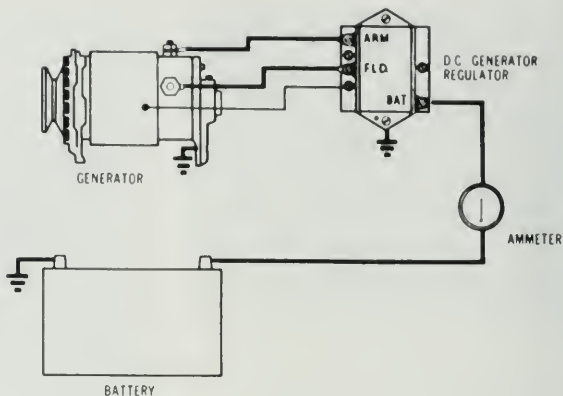


▲ The most expensive component of this home-built safelight is the safelight filter, available at photography shops for \$5 or less.

➤ Safelight with top and 8-x10-inch filter removed.



➤ Typical DC generator charging circuit.



Servicing Your Car's Generator

Using these tips on taking care of your DC generator and voltage regulator may save you a long walk to a service station some cold night

YOU MAY SAVE yourself a long walk to the "nearest service station" some day with an on-the-spot repair if you know what to look for when your generator gives out.

But if you inspect the generator-voltage regulator system every 10,000 miles or so, you may forestall more serious trouble by making bench repairs before they become emergencies. At any rate, you can do most of the work yourself.

These electrical powerhouses for your car are of three types. The generator field in some Delco-Remy and Auto-Lite systems is externally grounded through the mounting bolts. In types used in cars made by Ford, and some others (Ford, Bosch

systems), the generator field is internally grounded. Beginning with 1958 models, many General Motors cars had a third type controlled by Delco-Remy dual contact regulators that was used until GM went to alternators in the 1960s.

All systems with an internal ground can be identified by the presence of a ground terminal (marked "G" or "GND") on both the generator and regulator. All dual contact regulators are plainly marked with a red tag and also bear the warning "*do not ground*" stenciled in white ink (but the tag and markings are gone by now). This warning cannot be overemphasized. A momentary grounding of this new system will burn the second set of points in the dual contact regulator and may easily burn out the whole generator system.

What can go wrong? Basically, only three things: no charge (complete failure of the output), insufficient charge, or too much charge.

When there is no charge—the usual fault—the generator is not taking over for the

Servicing Your Car's Generator

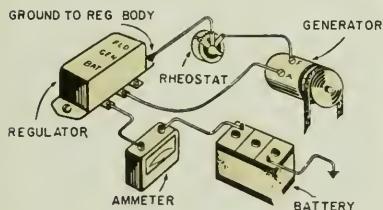
battery the job of supplying electrical power to run your car. In a late model car, you can tell this by your charge indicator bulb (irreverently dubbed "idiot light," as any idiot supposedly can tell when his generator isn't charging). It will light when you switch on the ignition and refuse to dim, no matter how fast you run the engine. If you have an ammeter, the needle will stay on the negative side through these operations.

Before running any tests, open the hood and check that the generator drive belt has not broken or slipped off its pulley. If in place, but loose, tighten the drive belt adjustment.

Basic no-charge tests. You need only a length of insulated wire, preferably with an alligator clip at each end, to check all generators except those using dual contact regulators. Connect one end of this jumper wire to the generator field terminal (marked with an "F"). If generator field is externally grounded, connect the other end to a good ground. If it is internally grounded, connect it to generator armature (marked "A" or "ARM").

Now start the engine and run it at a fast idle. If the "idiot light" goes out or ammeter needle swings to the plus side, the generator is OK and the trouble is in the wiring or regulator.

If you have a Delco-Remy system with a double contact regulator—once again—*don't ground anything*. This must be checked at the regulator, requires some equipment and is somewhat involved. If you want to try it, here is what to do.



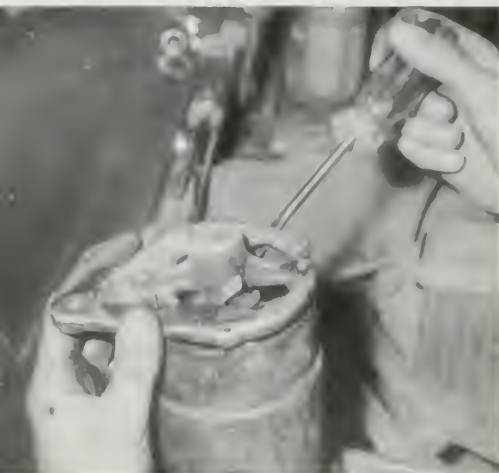
Secure a voltmeter-ammeter and connect it in series between the battery terminal ("B" or "BAT") on the regulator and the *nongrounded terminal* of the battery. Disconnect field wire from "F" terminal on the regulator and connect it to one lead of a 25-ohm, 25-watt variable resistance rheostat. (An old "clamp-under-the-dash" heater control will work.) Ground the other rheostat lead to the regulator body and set rheostat to wide open position.

Turn on all car accessories (lights, radio, heater, etc.). Start engine, run about one-third throttle and slowly turn off the rheostat until voltmeter reads slightly under 15 volts. A charge on the ammeter indicates regulator trouble. If no charge shows, make one more check.

Drop engine speed to a fast idle, remove the previous setup and turn off the accessories. Connect jumper between the battery terminal on the regulator and the regulator armature terminal ("A" or "ARM"). If you get a charge now, the trouble is in the



▲ Normal generator disassembly begins with removal of two, long through screws.



▲ Generator end plate is gently pried up with screwdriver. If end plate will not move, a paint scraper may be used to get it started.

▼ In center of generator is the armature. Rectangular segments form the commutator.



Servicing Your Car's Generator

circuit breaker or current regulator. If not, the regulator is OK and the generator is at fault, or possibly the wiring.

Dirty commutators. Probably responsible for most generator failures and one of the easiest ailments to cure. Sand commutator surface gently. *Never use emery cloth* since particles will imbed in the commutator surface to cause hot spots and burning. Do not use your fingers to hold the sandpaper. If you are stuck on the road somewhere, you can do an emergency cleaning job with an ordinary lead pencil eraser.

Where commutator appears worn or rough, you will be wise to have it turned down and the mica undercut at a garage. The cost is slight (\$5 at most) when compared with that of a new or rebuilt unit.

Midnight burr. While burring may not be so common, it has been known to happen. Something can get caught under a brush and dig a small groove in the commutator—just deep enough to form little burrs that short all commutator segments into each other. To cure it, scrape along the mica separators with a pocket knife to cut away enough burr to restore charging capacity.

Assuming we have pinned down the problem to the generator, but have not yet located it, remove the unit from the engine for the following tests and repairs.

Take off the cover band and clean the commutator thoroughly. Remove all grease, using a rag dampened with carbon tetrachloride and follow with the wood block-sandpaper technique for a good polish job.

Sticking or worn brushes. If brushes do not move freely in their holders, slip the holder retaining springs and lift out the brushes. Clean both brushes and holders thoroughly with a toothbrush and some carbon tet. If brushes are worn to half original length, install new ones. Seat new brushes against the commutator with sandpaper.

The common practice of wrapping sand-

Servicing Your Car's Generator

paper around the commutator and rotating it back and forth is not recommended. Since brushes usually face different directions, such procedure will not seat one of the brushes properly, which will lead to arcing in the generator.

If brush connecting wires or tension springs are broken, replace them. The same goes for any spring with tension so weak it will not hold a partly worn brush firmly against the commutator.

Commutator out of round; high mica. This usually accompanies severe commutator wear caused by a lot of generator mileage. In a case of severe wear, the remedy is to turn the commutator on a lathe and undercut the mica $\frac{1}{32}$ -inch below the surface of the segments. You can do the latter job alone (and often get many more miles of generator service before having the commutator turned) with a section of hacksaw blade stoned down to proper thickness.

Thrown solder on cover band. If little dabs of solder are splattered on inner surface of the cover band, something caused your generator to overheat, melting solder that holds the armature windings to commutator segments. In this case, some winding ends are probably loose and not contacting the commutator. If the separation is not too severe, you may be able to save the armature by a resoldering and reinsulating job.

Bench tests. Where trouble is still not located, lift the grounded brush and insulate it from the commutator with cardboard. Hook one clip of the test set-up to the "A" terminal and ground the other to the generator frame. If the generator is inoperative, has passed all other tests and shows negative (no short) on this one, you had better replace it. Further tests would require an investment in specialized knowledge and equipment to detect trouble and repair it.

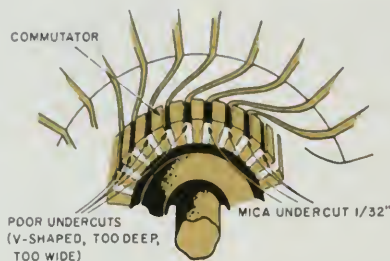
If the test bulb lights up, however, the short is in the brush holder, armature or field coils. Determine the source by close



▲ If commutator segments are rough, they can be smoothed with 00 sandpaper. One person holds sandpaper, another rotates pulley at front (turning armature). This procedure insures uniform sanding.

▼ Generator brushes may be in field pole body or on end plate (as illustrated). Replacement is simple: push back spring (at right) and push out brush from guide. Brush's wire lead is retained by screw, left.





▲ Mica insulates commutator segments from each other. Mica should be recessed 1/32-inch (by undercutting, which can be done with hacksaw blade). Undercutting prevents a dirt coating from shorting segments.

visual inspection, if possible; otherwise make the remainder of the illustrated tests. Once the short has been pin-pointed, the chances are you can correct it by taping the bared wire or replacing the faulty terminal insulator.

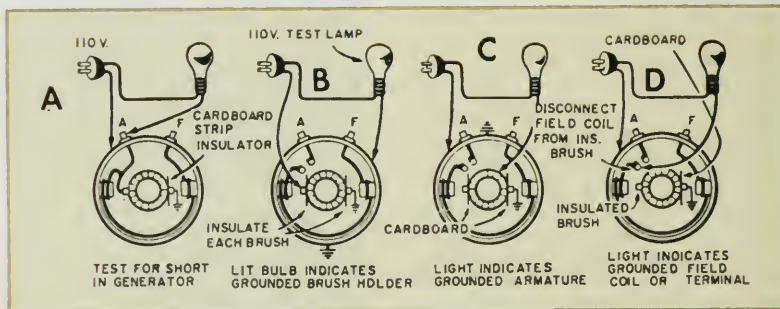
For low or irregular generator output, any of the conditions previously discussed may be the answer, except the loose drive belt. The cure is also the same.

For the cause of an overly high output in an externally grounded generator, make the test illustrated for grounded field coil or terminal. Trouble in the internally grounded type is probably a short between

the field and insulated main circuits. Correct this by taping up the exposed leads and eliminating the short.

What kind of replacement? If you decide to install another unit, let your pocketbook be your guide. Prices for new current model generators exchanged for your old unit are approximately \$30 to \$40; rebuilt units completely overhauled, turned, undercut and with new brushes installed average \$20. You can get a junkyard unit from a wreck (no guarantee, but they usually work) for \$10, or less if you bring your own tools and take it off yourself.

Regulator checks. A typical voltage reg-

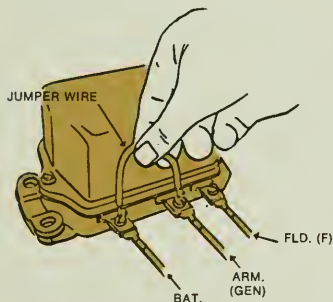


Servicing Your Car's Generator



◀ If a jumper wire from regulator base to ground cures a no-charge problem, try tightening regulator mounting screws, which provide the electrical ground. If tightening doesn't help, check screw threads for rust.

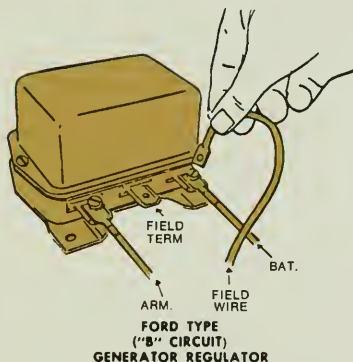
▼ Polarizing generator regulators. Regulators for "A" circuit generators can have terminals in different sequences, so be sure to identify armature and battery terminals on regulator before making jumper wire connections. ➤



**DELCO-REMY—AUTOLITE—PRESTOLITE TYPES
("A" CIRCUIT)
GENERATOR REGULATOR**

After making all connections but BEFORE starting engine:

1. Momentarily touch a jumper wire between "Arm" or "Gen" and "Bat" terminals of regulator. (The occurrence of a spark is normal.)



After making all connections but BEFORE starting engine:

1. Disconnect "Fld" wire from regulator terminal.
2. Momentarily touch this "Fld" wire to "Bat" terminal of regulator. (The occurrence of a spark is normal.)
3. Reconnect "Fld" wire to "Fld" terminal on regulator.

CAUTION: Never touch battery lead to "Fld" terminal of the regulator as this will damage the regulator.

ulator consists of three distinct magnetic switch units which automatically control the rate of charge within the battery-generator circuit. One switch—a cut-out or circuit breaker—automatically connects the generator circuit to the battery whenever engine speed is above an idle, and disconnects when engine is idling or stopped.

The other switches regulate voltage and current, cutting resistances into or out of the generator field circuit. When battery charge is low, resistances cut out, allowing the generator to deliver maximum power to the battery and bring it up to a full charge. At this point, resistances automatically cut back into the circuit to reduce generator power so it will just maintain the battery charge and keep its voltage within safe limits.

If trouble is indicated in your regulator, make the ground test first. Connect the jumper from regulator base to a good ground on the car body. If your regulator has a separate ground terminal, see that connections here and at generator ground terminal are clean and tight. After starting up and running engine at a fast idle, your "idiot light" should go out or ammeter show positive. If not, your regulator showing is defective.

For further tests of a dual contact regulator in a Delco-Remy system, refer back to the generator test procedure.

If you have an externally grounded generator, connect jumper between field terminal on regulator and a good ground. If the regulator has a ground terminal, connect jumper between it and the regulator body. If you get a charge signal during a fast idle, the regulator is at fault.

On internal ground systems, make this test by connecting jumper between armature and field terminals of the regulator. This hookup can be used in an emergency to drive the car short distances at low speeds until you can get the regulator fixed or replaced.

Servicing Your Car's Generator

Too much charge. If your battery is fully charged and a high charge rate is still indicated, run engine at a fast idle and remove wire from the regulator field terminal. If charge rate continues, you probably have a grounded or shorted wire somewhere in the wiring harness of the car. If the rate drops to zero, the trouble is in the regulator. Continued high charging may seriously damage generator armature, contact points and coil as well as burn out your car lights prematurely.

Too little charge. If battery and charge rate are both low, check for the most common causes—loose battery cable connections and corroded battery terminals. If they are cleaned and tight, run engine at a fast idle and cut the regulator out of the charging circuit. To do this on externally grounded systems, place a jumper between field and ground terminals of the regulator; on internally grounded systems, make the hookup between field and armature terminals of the regulator. If trouble is in the regulator, the charge rate should increase noticeably.

Since few faulty regulators are repairable, it's a good idea to buy a new one (around \$10 to \$15) when you find yours at fault.

Repolarization. After testing or repairing a generator, make sure its polarity is the same as that of its regulator and the battery it will charge. Before starting, if you have a dual-contact regulator, slip cardboard strips between brushes and commutator for insulation.

On externally grounded generators, make a "flash" jumper wire connection between "B" (battery) and "A" (generator armature) leads at the regulator. Polarizing action occurs instantly. On internally grounded units, remove field lead from regulator and contact it momentarily with the "B" regulator terminal. P.W.

See also: ALTERNATORS, AUTO; BATTERIES; ELECTRICAL, AUTO.

How to Build a Deacon's Bench

Construct this piece as a telephone bench or eliminate three parts and make it an ordinary deacons bench

CHOOSE THE VARIATION that suits your needs when you build this deacon's bench of plywood. The design is such that the piece can be built as a telephone bench or as a bench for two persons.

The original piece was built of birch plywood. Oak, mahogany, ash or any other plywood could be substituted to meet individual tastes. Exposed edges are covered with matching flexible wood trim applied with contact cement.

Study the plan carefully before beginning the project. With a pencil, lay out all pieces to be cut on a single 4 x 8-foot sheet of the selected plywood. It may be helpful to make cardboard patterns of the various smaller parts, shifting them around on the plywood to find the most economical cutting layout. Straight cuts may be made with a circular saw, either table or portable, or a radial saw. For the carving cuts, a saber saw is best. Both circular saw and saber saw cut on the up stroke, tending to splinter edges of the top surface, so it is best to use these tools with the back surface of the plywood up.

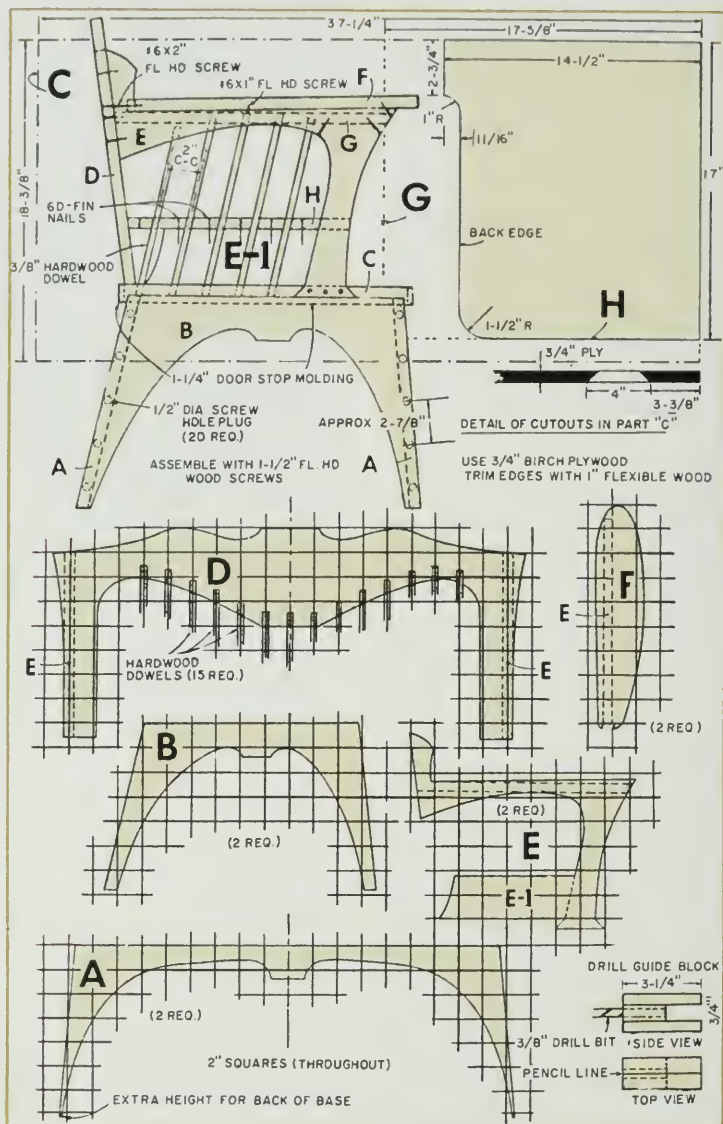
Note the two parts A—front and rear



▲ This version of the deacon's bench seats one person. The other half of the bench has space for writing messages as well as shelves for telephone, telephone books and related items. Version without shelves seats two persons.

bases for the bench. The rear part A has slightly longer legs than the front, because it slopes at a greater angle. The extra height is shown in the cutting diagram.

Drill pilot holes for screws in parts B, closely following the locations as shown on the pattern and countersinking for hole plugs. Cover front and rear edges of parts B with flexible wood trim, closely following manufacturer's instructions. On a flat surface, assemble the base of the bench (parts A and B) upside down. Trim and level the lower ends of the legs, then cover remaining exposed edges with wood trim. Glue hole plugs in place.



Note the cutout in each end of part C to accommodate the bench arm supports (parts E). The detail on the construction drawing gives the exact location. If you have a drill press, use it to drill the angled dowel holes in sides and rear of part C. If you do not have this machine, you will have to make a guide block to assure accurate drilling of these holes. Use a piece of hardwood 1½ inches square x 3½ inches long, with a ⅜-inch hole drilled at the angle of the holes as shown on the pattern, ⅜-inch in from the edge of the block. Mark a pencil line on the side of the block to line up the center of the angled hole with location marks penciled onto the side of part C. Note that the hole angle for the back differs from that for the sides; you will need another guide block for this.

Cover the inside edge of part D (the back) with wood trim, then use the guide block pattern shown in the detail to drill blind dowel holes in this piece. Dowels are fitted through the holes in the seat (part C) and gently tapped up into part D. When firmly seated, dowels are trimmed off at the bottom. Cover remaining edges of part D with wood trim.

Cover the inside and front edges of parts

E with wood trim, then drill holes for dowels with the same guide block used on part D. Attach the arms (parts F) after covering the edges with wood trim. Now attach these assemblies to the seat and back with wood screws (see drawing). Fit dowels as above.

If you are building the phone bench version, attach part E-1 with glue and 3 #6 x 1½-inch wood screws driven up through predrilled holes in the seat. Cover all exposed edges of part E-1, except the front edge, with wood trim. Now attach lower and upper phone shelves (parts G and H) with wood screws positioned as in the drawing.

Cover any remaining exposed edges with wood trim. Now attach 1¼-inch door stop molding to all edges of the seat with glue and 4d finishing nails. To attach the base to the seat, upend the assembly and use four metal corner braces with appropriate length screws. Attach a furniture glide to the end of each leg of the base.

Carefully sand the entire piece with a fine grade of sandpaper, and finish.

Original design by Steve Ellingson.

See also: FINISHING, WOOD; FURNITURE, INDOOR; WOODWORKING.

MATERIALS LIST

Quantity	Size and Description	Purpose
1	¾" 4x8' birch or other plywood	basic unit
12	¾"x36" hardwood dowels	sides and back
8 rolls	1"-wide flexible wood trim	
20	½" diameter screw hole plugs	
	1¼"x10' door stop molding	
as needed	#6x1½" flat head wood screws	
as needed	#6x1" flat head wood screws	
as needed	#6x¾" flat head screws	
as needed	#6x3" flat head screws	
4	metal corner braces	
4	½" furniture glides	

Note: Also need contact cement, fine sandpaper, glue, finishing materials.



How to Build a Wooden Patio Deck

**Putting a deck over part
of your yard will increase your
enjoyment of outdoor
living and entertaining,
as well as add to the
value of your home**

THIS PATIO DECK makes a comfortable outdoor living and entertaining area and it cuts down on the amount of grass you'll need to mow. The structure is based on use of four-foot-square deck panels; overall dimensions can be adapted to any size yard, but the dimensions must remain in multiples of four feet.

This deck has a matching built-in bench, and the screen. Note, too, the open area left for a tree. When you plan your deck, you can leave such spaces for existing trees

or shrubs, or include such plantings in your plan.

Mark out the area to be covered by the patio alongside the house, and use stakes and strings to establish the base line level. Any high spots will have to be cut down, and grass should be removed.

Attach perimeter strips of 2 x 10-inch stock to the side of the house with lag bolts, using one-inch stock spacers to hold the 2 x 10s away from the foundation wall. If the wall is concrete slab or block, drill first

How to Build a Wooden Patio Deck

for lead inserts to take $\frac{3}{8}$ -inch diameter lag screws.

Plot the locations for the pier blocks. These are concrete blocks to support the deck framework. Set the blocks in concrete and level them carefully. Fill each block with concrete, and insert a $\frac{1}{2}$ -inch metal rod. The rods must protrude no more than two inches above the blocks.

Deck framing is made up of lengths of 2 x 6-inch and 2 x 8-inch stock. The 2 x 8s go over the pier blocks, and must be drilled to accept the metal rods in the blocks.

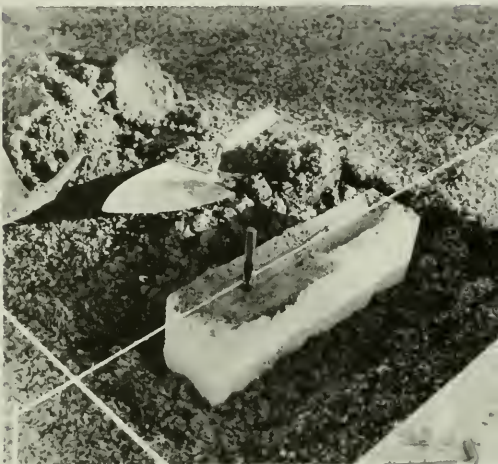
When the basic framework is complete, attach 2 x 2-inch strips to the inside of the perimeter framing.

Dig holes for the posts for the decorative screen. These posts are of 4 x 4-inch stock, and each is notched to take the 2 x 10-inch perimeter framing. Install the posts with $\frac{1}{4}$ x 3-inch lag screws and $\frac{1}{4}$ -inch fender washers. Be sure there's ample space on all sides and below the end of each post, then pour concrete into the holes.

Bench posts also are of 4 x 4-inch stock, notched at the bottom to take the framing members, and at the top to take the bench seat supports. These posts do not extend below the deck framing.

All deck panels are presumed to be identical, but it's best to lay each out over the square it is to occupy in order to adjust for minor errors. Start by cutting two end crosspieces to fit snugly between framing members. A snug fit is needed so they will hold the panel firmly in place when it is installed. Tack them lightly in place.

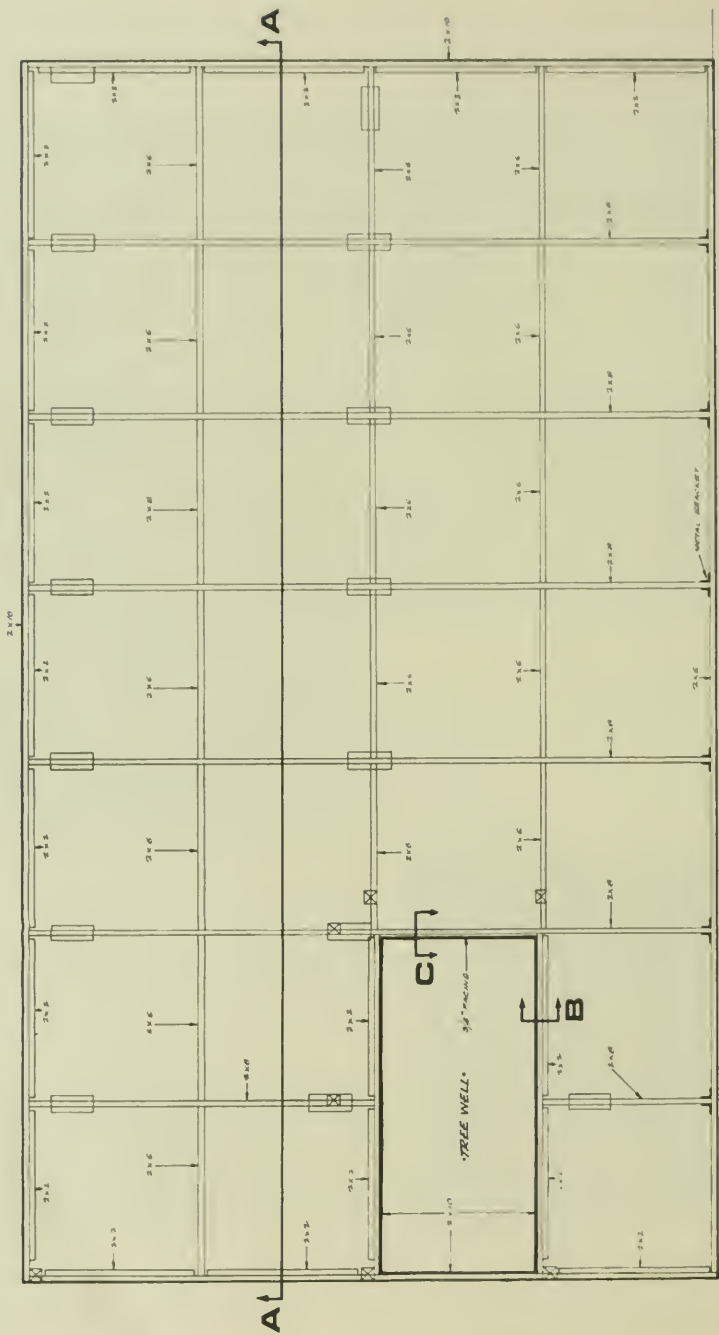
Now cut two 2 x 4s and position them so that one end has $\frac{1}{4}$ -inch clearance be-



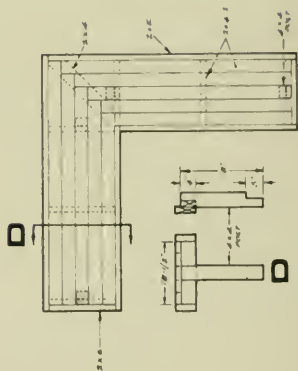
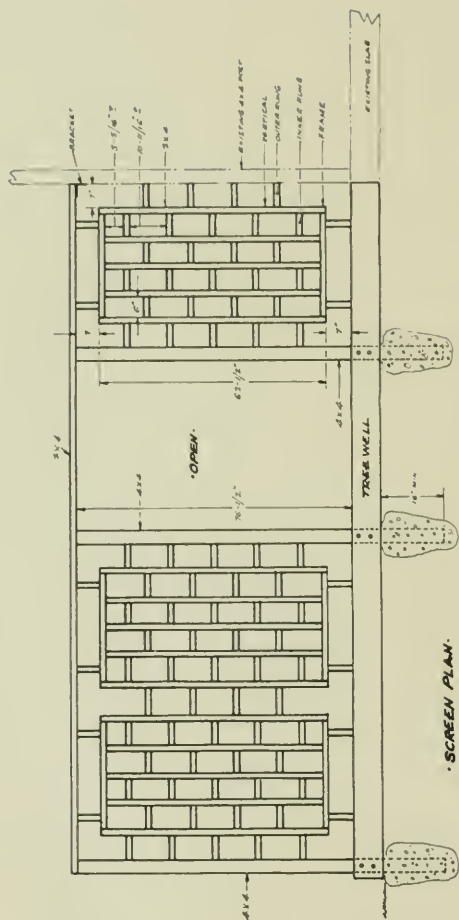
★ Plot the locations of your pier blocks according to your design. Keep in mind that piers only go beneath the 2 x 8 framing and that the span between piers should not exceed eight feet. Set each block in concrete and level it. Then fill one hole of the block with concrete and insert a $\frac{1}{2}$ -inch metal rod. The rod should not project more than two inches above the block.



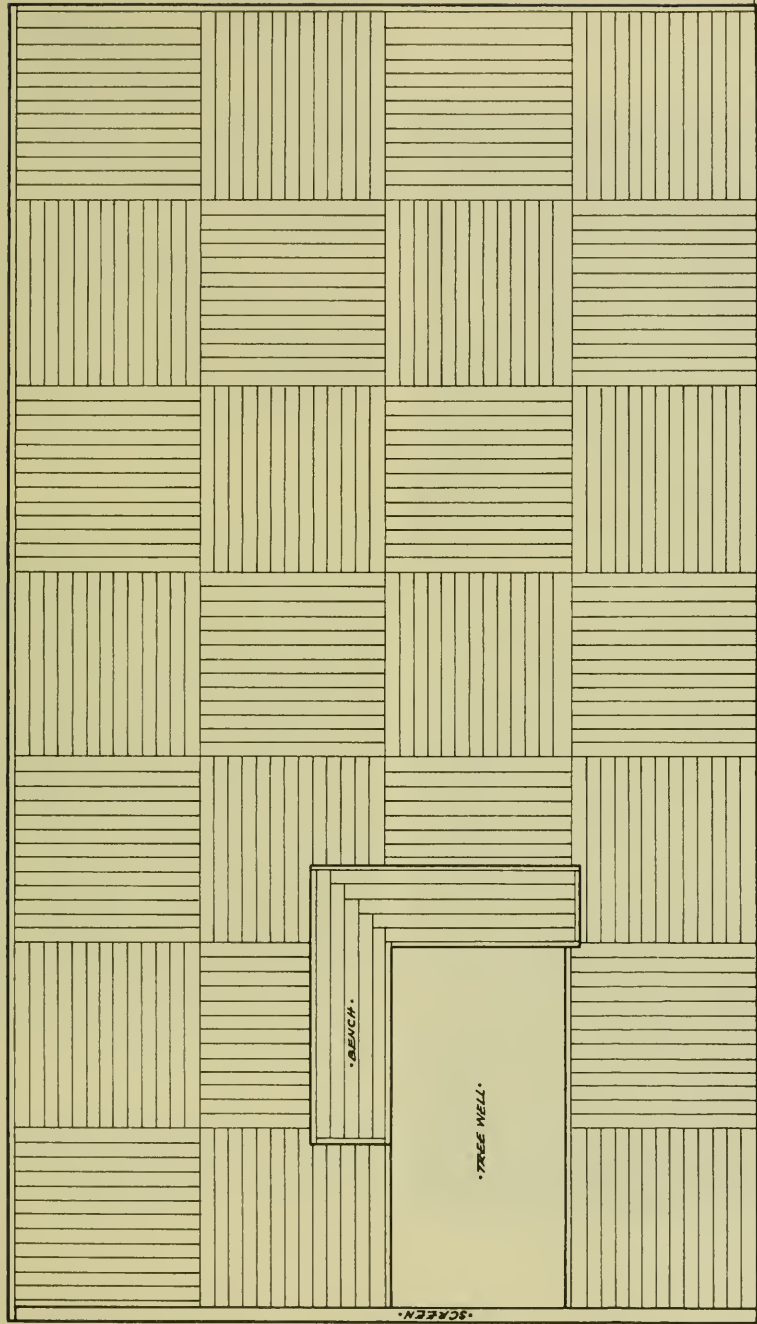
✦ After you have laid out the area for your patio, the first step is to attach perimeter stock to your house. If the house foundation is masonry, use $\frac{3}{8}$ -inch diameter lag screws with lead shields in drilled holes. Drill the holes on 36-inch centers. If the foundation is wood, use 16d nails on 16-inch centers. In either case, insert spacers of one-inch stock between the house and the 2 x 10s.



• FRAMING PLAN •



• BENCH PLAN & CROSS SECTION •



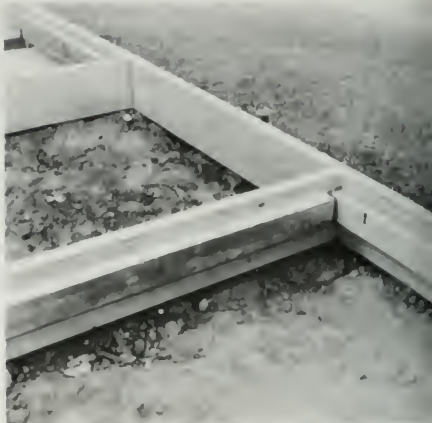
DECK PLAN

EXISTING 4x4 POST

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▲ Deck framing is well under way.



▲ Attach 2 x 2 strips inside perimeter timbers to support the deck panels. These strips are needed only along the perimeter.



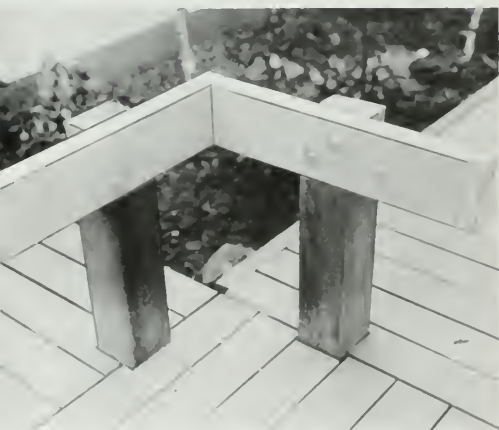
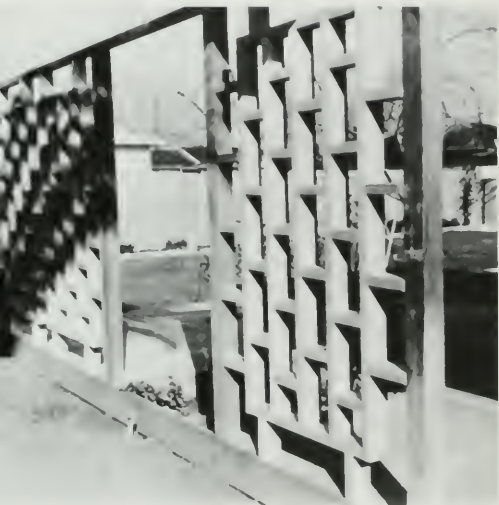
▲ Notch the bench posts to fit over the framing and attach them with lag screws through the framing into the posts.

◀ Posts for screens are 4 x 4 stock notched to receive the 2 x 10 perimeter pieces. The posts are attached to the 2 x 10s with $\frac{1}{4}$ x 3-inch lag screws with fender washers. Each post is set in a hole that is filled with concrete after the post is attached to the perimeter piece.

➤ Lay out each deck panel over the square it will cover. This will allow adjustments for minor errors. Cut the end crosspieces to fit snugly, then place the end pieces of the 2 x 4 paneling on top of them. The panel piece at the left goes $\frac{1}{4}$ -inch from the existing panel and the outside edge of the one on the right goes on the centerline of the framing member. Mark the four pieces so you can reassemble them in exactly the same way when you make the panel.

➤ Reassemble the crosspieces and panel ends on the floor upside down so you can nail through the cross members into the panel pieces. Slide the remaining decking into the panel and tack each piece in place with a 2 x 2 at each edge. This will keep the decking in place while it is being nailed. Nail through the end crosspieces into each piece of decking. Then, install a slightly shorter center crosspiece in the same way and the panel will be complete.





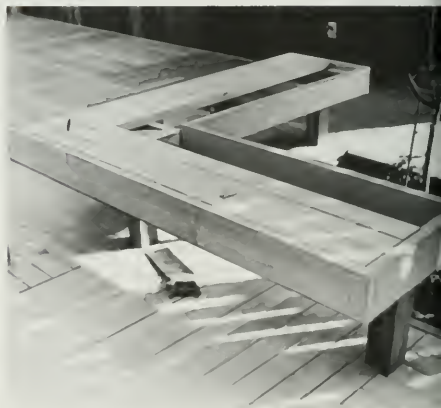
▲ Center bench posts with supports installed. Each support is fastened to post with $\frac{1}{4}$ -x 3-inch lag screws and fender washers.



▲ End bench post with bench support attached.

◀ Assemble screen of 2 x 4 pieces, then toenail each outside piece to framing and 4 x 4 posts.

▼ Bench seat is partially completed.



How to Build a Wooden Patio Deck

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tween it and the adjacent panel, and the other end is positioned along the centerline of the framing member so there will be 1/4-inch clearance between it and the next panel.

Mark the end crosspieces and the two 2 x 4s so they can be matched exactly when reassembled. Remove them, and assemble upside down by nailing the end crosspieces to the 2 x 4s with 10d galvanized nails. Cut the remaining 2 x 4s for the panel to length, and slide into position as shown. Tack 2 x 2s along the two edges so they will remain lined up while they are being nailed permanently.

Add the center 2 x 2-inch strip and remove the 2 x 2s that had been tacked along the edges. The panel then can be set into position on the framework. Don't nail it down. You'll want to be able to raise it to

retrieve coins or other objects that may drop between the planks.

The decorative screen is made entirely of 2 x 4-inch stock. Attach the horizontal "rungs" to the inner vertical members first, then toe nail the outer rungs to the 4 x 4-inch posts and the 2 x 4-inch top member.

Make up the two bench ends of 2 x 4-inch and 2 x 6-inch stock, and bolt to the end bench posts with 1/4 x 3-inch lag screws and 1/2-inch fender washers. The center bench posts take 2 x 4-inch supports only. Add the 2 x 6-inch bench frame members. Note the installation of the angled 2 x 4 in the seat corner, and the extra 2 x 4-inch braces in the center of each bench. Finish by installing the 2 x 4-inch bench planks.

Original design by Steve Ellingson.

See also: FURNITURE, OUTDOOR; LANDSCAPING; PATIOS.

MATERIALS LIST

Quantity	Size and Description	Purpose
	2" 10"x78' lumber of your choice	perimeter
	2" 8"x102' construction grade fir	framing
	2" 6"x70' construction grade fir	framing
	2" 6"x28' lumber of your choice	bench
	2" 4"x1,352' lumber of your choice	deck panels
	2" 4"x162' lumber of your choice	screens
	2" 4"x56' lumber of your choice	bench
	2" 2"x300' construction grade fir	deck panels
	2" 2"x72' construction grade fir	panel supports
	4" 4"x28' lumber of your choice	screen
	4" 4"x6' lumber of your choice	bench
	3/4" 10"x4' pine	facing
as needed	metal angles	
as needed	3/8"x3" lag screws with lead shields	
as needed	10d galvanized nails	
as needed	20d galvanized nails	
as needed	1/4"x3" lag screws with fender washers	
as needed	4" 8"x12" concrete blocks	
as needed	bagged concrete ready for mixing	

How to Build Wooden Decks

Increase the value of your home and add to your enjoyment. Here's how to build two decks. Or, design your own using these ideas as guides

OUTDOOR LIVING AREAS can be made of many different types of construction materials, but there are many locations (on the side of a hill, for example) where wood is the best choice. Wood is lightweight compared with most other materials, and easy to cut and join. This makes it an ideal material for building do-it-yourself decks. Shown here are two different styles of wood deck that you can build to any desired size. One is a raised deck that can serve an upper level room to which a connecting outside door can be added. The other is an eye-appealing ground-level hexagonal deck that will gain in charm when set off by appropriate plantings.

The decks can be made of any of many different types of wood. Redwood is popular for such outdoor projects because it will not rot, although you must watch out for splintering. Other usable woods, if properly treated against weathering, include: Douglas fir, Engelmann spruce, Idaho white pine, incense cedar, Lodgepole pine, sugar pine, ponderosa pine, Sitka spruce, white fir, western hemlock, larch and red cedar.



Check your town building code to make certain that your planned deck will conform with local regulations. Treat all wood members with preservative, and use nothing but galvanized iron or non-ferrous nails and other hardware. If the deck is to be located next to your home, anchor it to the building for added stability and strength. Eliminate any combustible materials, including dry grass, from the area that will be underneath the deck, before starting construction.

Hexagonal deck. Start laying out the position of this 12-foot diameter hexagonal deck by marking off a perfect square measuring 12 feet on a side using stakes and cord. Find the mid points along two opposite sides of the square, and run a cord between stakes located at these points. As shown in the drawing, measure two feet, six inches in from each corner along the two other sides of the square, and connect these four points diagonally as indicated. You now have located the center and three axes of the hexagon.

Along each section of cord radiating

How to Build Wooden Decks

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from the center, measure a distance of six feet to locate the end positions of the stringers. You are now ready to dig holes for the seven concrete piers. Note that for maximum stability the mid point of each pier is pulled a few inches closer toward the center than the measured end of the stringer that will go on it. Stabilize the concrete piers by packing gravel ballast around them, after checking to see that they are all level with each other. Do this by placing a carpenter's level atop a 12-foot stringer connecting the various piers.

Start assembling the 2 x 6-inch stringers by placing a full 12-foot length across two opposite piers. Rough-position six-foot stringers from the center to the other four outside piers and mark the cut angles at the center. After cutting, reposition the stringers and toenail in place using 10d nails.

Check measure the distances between the ends of adjacent stringers to be sure that they form the axes of a perfect hexagon. Now mark and cut the six fasciae and toenail them to the stringers after first laying them all in place and checking the symmetry of the hexagon. Note that the stringers extend a short distance beyond the points where the fasciae are joined so that nailing will not split the stringer ends.

The stringers and fasciae will not of themselves provide sufficient support for the deck boards. You must provide additional supports of the same 2 x 6-inch stock as shown in the drawings. After this is done, drive bracing stakes into the ground at various points next to the stringers and nail these to the stringers.

To apply the decking, begin at the center by centering the edge of the first deck member over the 12-foot stringer. Then apply the remaining decking, using a 10d nail as a spacing guide between the members. Nail the decking to each stringer with two 10d nails which should be countersunk. Stop and check the alignment after laying every

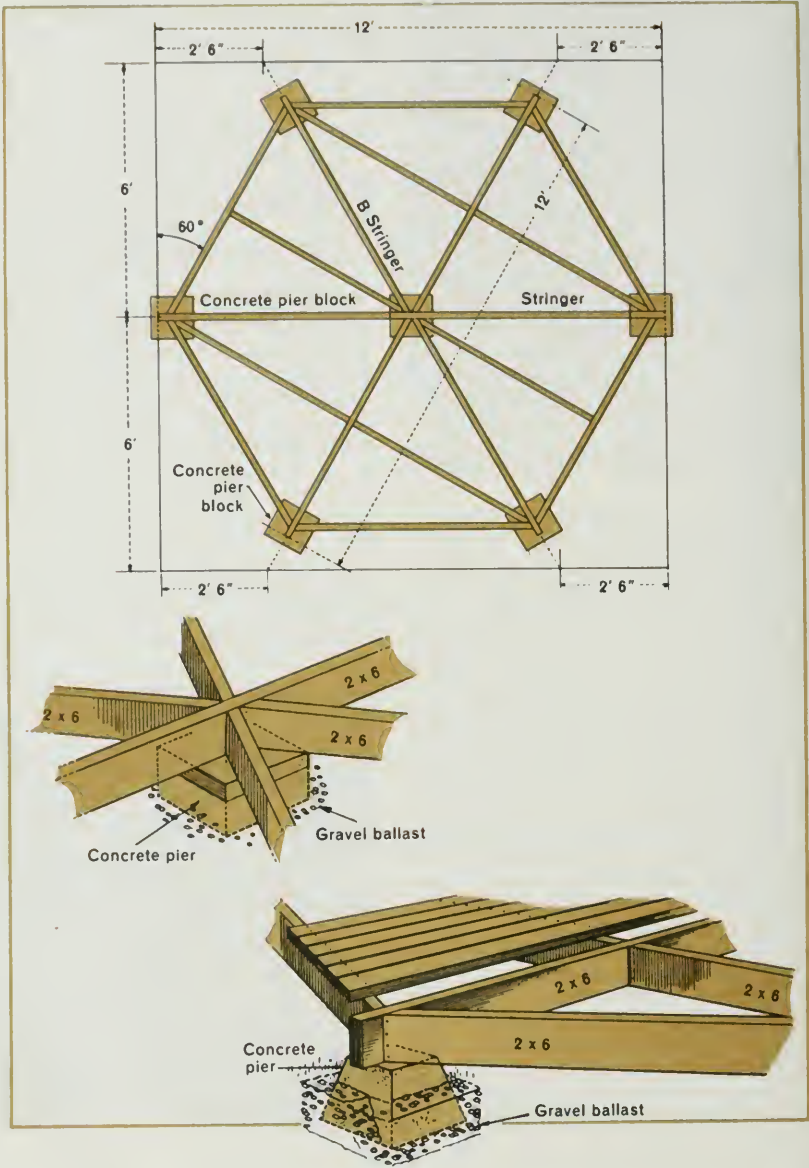
five or six boards. If things are going a bit askew, adjust the alignment by slightly increasing or decreasing the width between deck members.

As you lay the decking, use stock that is a little longer than it will be in the finished deck. Do not attempt to cut to exact length before laying the members. When the entire deck has been laid, tack a trim guide in place near each edge and trim all the board ends at once using a portable power saw. Allow two inches of overhang, and ease the edges with a wood rasp or file. This completes your hexagonal deck.

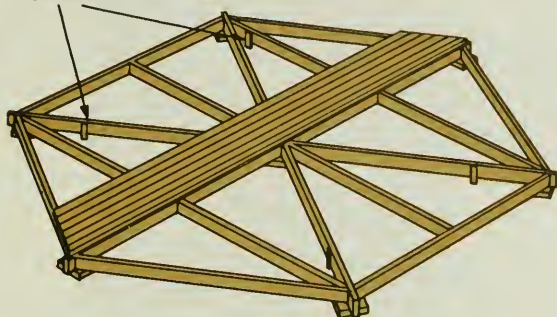
Raised deck. If you wish to build a raised deck to the 12 x 12-foot dimensions shown here, start by locating the positions of the three pier blocks by referring to the accompanying drawings. Don't be misled by the overall dimensions of the framework; the two-inch deck overhangs will increase the deck size to a full 12 x 12-foot area.

Install pier blocks by digging down to solid ground or bedrock. Level the bottoms of the holes, drop in the blocks, and stabilize by packing gravel around them.

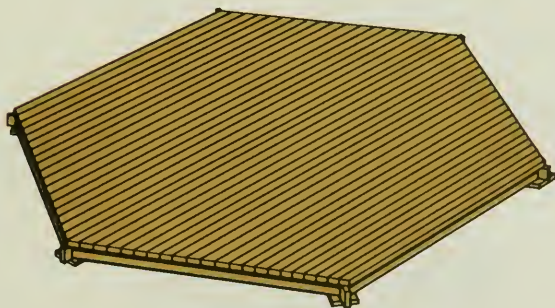
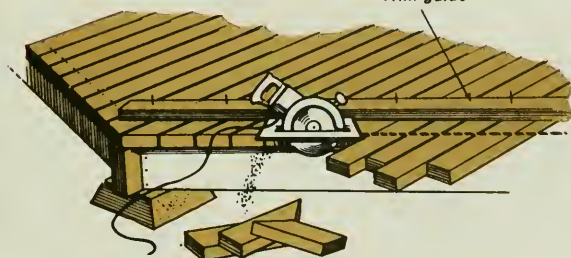


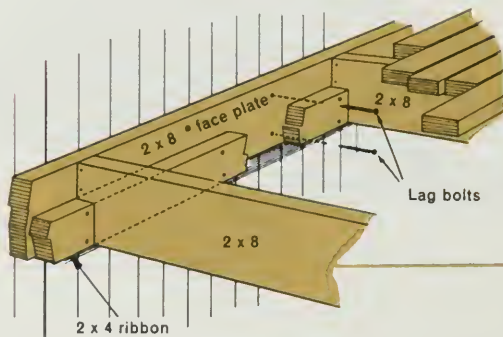
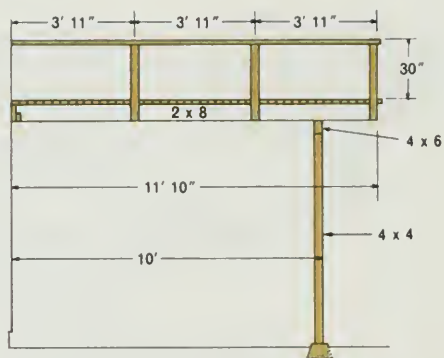
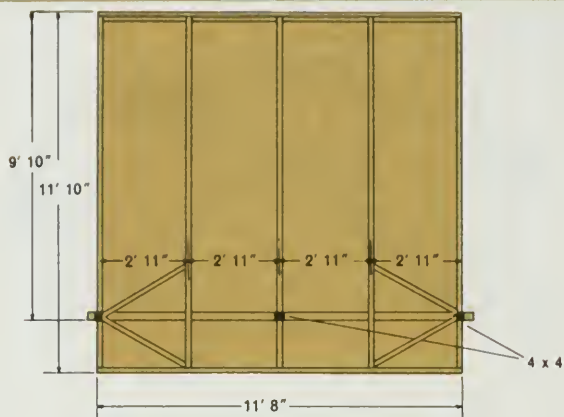


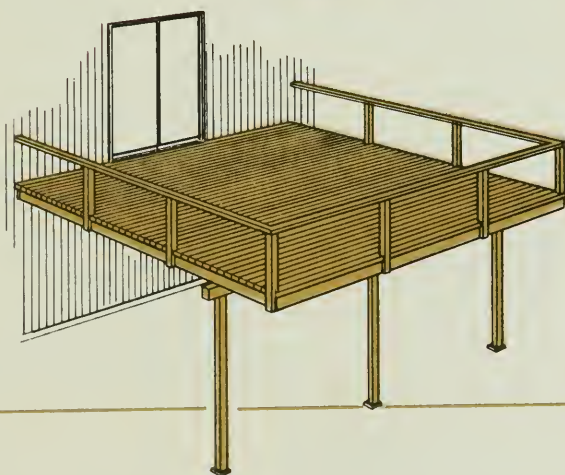
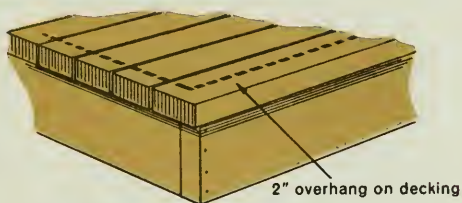
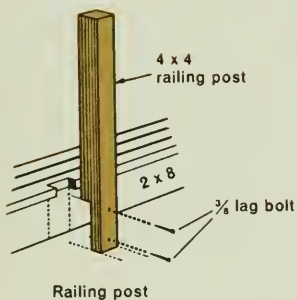
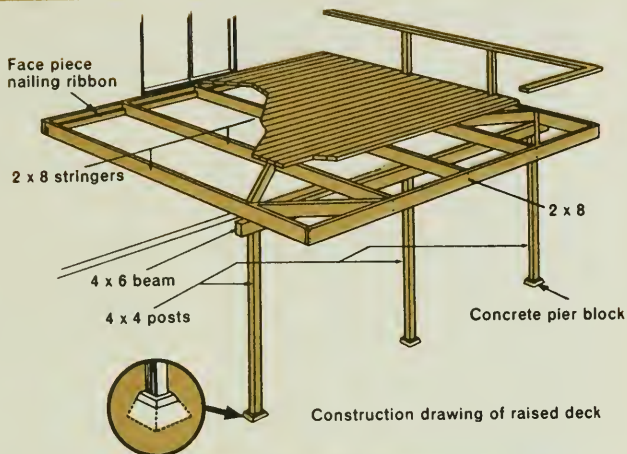
Bracing stakes for anchoring to ground



Trim guide







For a faster but probably somewhat less permanent job, just sink the 4 x 4-inch posts directly into the ground for a minimum of three feet and fill the spaces around the posts with gravel. Be sure to use heart cedar or wood that has been pressure treated with preservatives.

Next attach the supporting face plate and nailing ribbon to the side of the house. Start by locating the 2 x 4 framing studs beneath the house siding, at the proper height. Drill holes through the 12-foot, 2 x 8-inch face plate and into the stud at one end of the face plate, and then into every fourth stud. Fasten the face plate to the wall by screwing lag bolts into these holes. Attach the 12-foot, 2 x 4-inch nailing ribbon to the face plate using 16d galvanized nails, two at a time, spaced at 16-inch intervals.

An optional method of constructing the face plate and nailing ribbon uses a heavier 2 x 10-inch face plate and a smaller 2 x 2-inch nailing ribbon. If your home has beveled siding, use furring strips between the face plate and the house wall.

Raise the three posts and brace them into position, checking to see that they are plumb by using a carpenter's level. Install the 4 x 6-foot beam atop the posts and toenail into place. Here again you have an

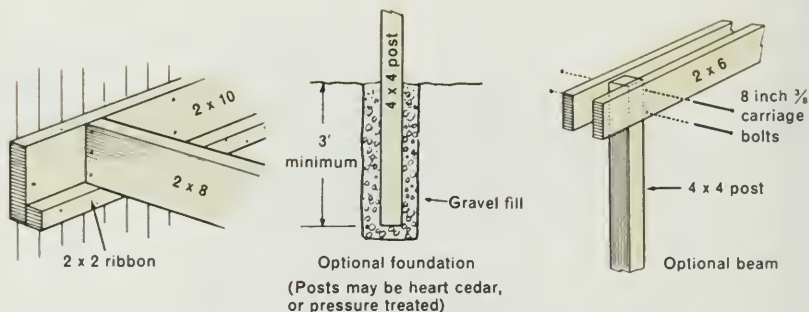
alternate method, constructing a beam of two 2 x 6s bolted on opposing sides of the posts at the tops.

The next job is to notch the 12-foot, 2 x 8-inch stringers with 2 x 4-inch notches at one end only to fit the face plate and nailing ribbon. Before nailing these in place, make certain that everything is plumb, level, and properly proportioned. When the stringers are in place, add four diagonal beam braces as shown in the drawings.

You are now ready to install the 39 pieces of 12-foot, 2 x 4-inch decking, using a 10d nail as a spacing guide between the members. Nail each deck member to each stringer with two 10d nails, and countersink the nail heads. Check the alignment after adding every five or six boards, and adjust the alignment, if necessary, by increasing or decreasing slightly the spaces between deck members to be added. When you are through, you should have a two-inch overhang on three sides of the deck.

Notch the eight 4-foot, 4 x 4-inch railing posts and the decking as shown in the drawing and attach with $\frac{3}{8}$ x 3-inch lag bolts after pre-drilling the posts, stringers and fascia. Install the railing cap using two 10d nails per post.

See also: PATIOS.



Pennsylvania Dutch-style Decorating

Quaint and colorful, it will provide a charming finish for many of your furniture projects



▲ *Delicate flower, tree and bird motifs make the simplest piece of furniture an object of interest. Note how little finger steadies the hand while making tiny designs.*

PENNSYLVANIA Dutch-style decorating has a long and honorable record in the annals of American ornamentation. Light-hearted, gay and colorful, it has lent its charm to many homes over the years. Blending easily with the old and the new, it is welcome everywhere.

There is no need to research original old designs—look around you for inspiration. The form of a petal is one of the simplest to start with, and exactitude is not what you are after, so don't aim for geometric precision. With a little practice and imagination, you will be able to create patterns and designs to suit the project at hand.

Materials needed. An inexpensive collection of artists' brushes (be sure the bristles are soft), an assortment of colors in the smallest size can available (leftovers from regular paint jobs are suitable) and scrap wood or cardboard will do for practice. Since these designs are mostly used on furniture, regular enamel is fine for the purpose; it has "body" and will not tend to drip or run off the brush. When you intend to work on wood, the surface should be sealed so that the colors will not seep and spoil the clarity of the design. If a basic background color is desired it should be done in a flat enamel. The design can run

on a slick, glossy surface. If you want to have a natural wood tone as background, shellac is an excellent sealer, since turpentine, used to clean up errors, will not affect it.

Practice the technique. The design used most in the illustrations is a familiar flower-and-fruit motif. The method employed is really very easy to master. Load your small brush, rest it on the surface of the project (or your practice board) and raise it quickly, pulling the brush upwards and off the work, toward your body. Continue this exercise until you have a fairly good looking petal. The next step is to form a whole blossom. At first, it is wise to turn the practice board after forming each petal—thus you can use the same stroke each time.

After the petals are grouped in a circle, use an almost dry brush and simply dot the center. Try this step separately, as it is easy to put a blob instead of a dainty center in your flower!

After this basic design has become easy for you, try it in a composition of your choosing, as a border, or as the center of a more elaborate pattern. As you become more adept at this starting figure, try your hand at making the complete flower without turning the board or card, as it is not

decorative block screens: see concrete blocks
decorative bookshelf-table: see bookcase
decorative candles: see candle making
decorative concrete: see concrete, decorative
decorative plaques: see craft projects

always practicable to do this with, say, a chest or bureau.

Another simple design is the tree. The same basic method is used as in painting the petal, but the brush is less heavily loaded so that light, even, upturned strokes form the branches. Again, dots may be used to indicate the center, or trunk.

When at a loss as to how to fill in an all-over pattern, dots and dashes, done with quick, light, even strokes, can lend surprising sparkle. For borders and stylized patterns, you will develop little curls and feathery lines that are your own trademark.

For a sophisticated note, try using a good grade of gold leaf effect enamel over flat black enamel, and seal the finished job with a cabinet finish. This will prevent the flat black from smearing the gold designs, and add a lustrous sheen to enhance your handiwork. And don't ever worry about irregularities in the designs—these are free-hand, original artworks, not factory-machined products.

For stylized designs. When doing a large piece of furniture, free-hand work may be too tedious and time-consuming; also, a change of pace may be required to avoid monotony in pattern. Here even the beginner can do a magnificent job with a minimum of effort. The means are readily at hand. A French curve, sold at all art supply departments, is an inspiration in itself and, with a little imagination and practice with pencil and paper, can provide a tremendous variety of designs. A combination protractor, French curve, ruler and circle gauge (available in the school supply departments of five-and-ten cent stores) is cheap and fun to use. It can do double duty, as the forms may be filled in with solid masses of color inside or outside of the pattern, depending on your own ideas, or may simply lend themselves to a delicate tracery for a repeated pattern on a large surface.

Sometimes the humblest gadget around

the house will provide a basis for imaginative beginners, the base of an oil can, for example. The simple oval form is a natural for large floral or border patterns. To use it for a very formal border, have the ovals meet, or, if you want a more elaborate effect, let them overlap. For this type of border, trace around the can; shading is used most often in the floral pattern.

Classical motifs. The "hex" signs found in Pennsylvania have been a source of decorative inspiration for years. They are usually round and can be duplicated with a compass. Various motifs with special meanings may be used. This is where the ardent researcher can come up with authentic reproductions. The French curve and a ruler will enable you to duplicate them.

Working with colors. When working with a number of colors, it is a good idea to have a small container of each color and a container of solvent. This way, you can change from one color to another as the work progresses, and dunk your brushes in the solvent when they are not in use. As these brushes are inexpensive, a brush for each color is a good investment. A quick dunk, and a wipe just before re-use makes for soft, pliable bristles at all times. Handy tip: if by chance your brushes harden from a hasty cleanup, nail polish remover with lanolin or other oil not only cleans, but restores flexibility to small brushes such as these.

Color values. If you are attempting to duplicate a true antique, keep in mind that the colors used long ago were soft and muted, as pigment was whatever was at hand, such as vegetable dye or powdered clay. With the brilliant array of paints on hand today, it is easy to go overboard on the color scale. Not that there is anything wrong with gay and brilliant hues—this is just a note of caution to the over-zealous beginner. However, if after your arduous work you think the color scheme too gaudy, all is not lost. In fact, there is hardly any-

Pennsylvania Dutch-style Decorating

thing you can do in this type of art work that cannot be rectified. A coat of half-and-half orange and white shellac will tone down the most wayward colors, and impart a mellowness similar to the patina found only on the original old pieces. Followed with a light sanding and waxing, it would be hard to distinguish from a real oldie.

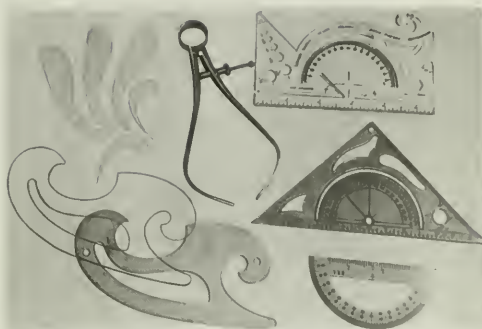
Oil-painting effect on a plaque. When decorating a plaque to be wall-mounted or used as a tabletop, the richness of depth in real paintings is often desirable. There is a quick and easy way to gain this effect without any further skills than the techniques described earlier. After the design is finished, simply go over each part with a small, soft artist's brush using a heavy-bodied cabinet finish. Build up successive coats until you achieve the effect you want. Use it on the design only until the final coat, when the entire piece is coated. A brilliant, dimensional appearance will result, and the surface will be impervious to everyday wear and tear—not always the case with true oil painting jobs, where the softness of the oil paints may be subject to digs and scratches from glasses or ashtrays.

Tips to help the beginner. If you are wary of trying designs, there is a cheap and easy way to practice your skill. Use a small bottle of inexpensive nail polish to gain confidence. As it dries quickly and comes with a brush built into the bottle cap, it is a splendid medium for practice. In fact, if it were not for the limited color range, it would be an excellent medium to use all the way.

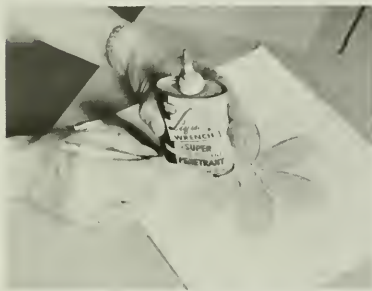
Most beginners suffer unduly trying to hold their hands steady. There is a simple method for this, used by professionals. Use your little finger as a guide-rest. You will be amazed at the control your little finger gives as you work, allowing you to paint even, straight designs.

G.D.

See also: ANTIQUING; FURNITURE, INDOOR; FURNITURE, USED.



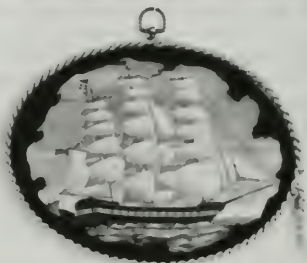
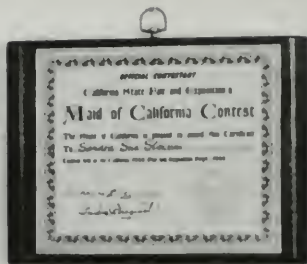
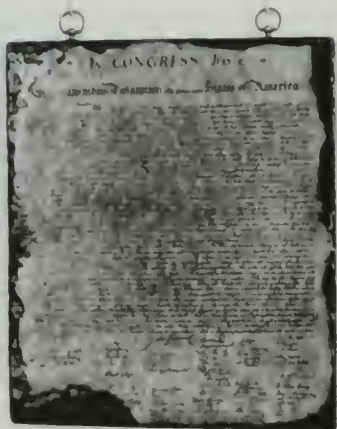
▲ Inexpensive drawing guides. Caliper is used as guide for graceful curves.



▲ Patterns are where you find them. Here, ordinary oil can provides petal design.



▲ Gold-leaf enamel is used to advantage on black to beautify this chair.



▲ Simple, inexpensive decoupage techniques were used to create these plaques. Declaration of Independence at left was discolored by heat, charred at the edges, and mounted on a charred board to give it an aged look. The same effect was achieved in the sailing ship print by tearing and charring the edges. Document at right, top, was mounted on a stained board rather than in a frame.

How to Decorate with Decoupage

Use this simple, inexpensive technique to mount a document, or decorate a box, purse, tray or furniture with printed designs

YOU CAN USE decoupage to apply almost any design or picture you wish to a plaque, box, tray or piece of furniture, as long as you can find the decoration printed on a suitable piece of paper.

The ease with which decoupage is practiced is probably the reason for its wide-

spread popularity, just as it was the reason for the technique's beginnings.

Decoupage originated in Europe in the 18th century—the term comes from the French *couper*, to cut—when craftsmen and hobbyists used it in an attempt to imitate elaborately decorated Chinese and Japanese lacquerware. Printed decorations that were pasted on a piece of furniture would not require the painstaking brushwork of a skilled artist.

The technique failed as an attempt to imitate Oriental art, but it quickly became a craft in its own right, and its basic techniques are essentially the same today as they were two centuries ago. Paper dec-

How to Decorate with Decoupage

orations, designs, pictures or documents are glued to wood, then buried in many layers of clear wood finish to protect the surface and eliminate the "pasted-on" look they would have if they were left uncoated.

In some cases, decoupage pieces can be distressed and antiqued to give them an old look.

The first step is to prepare the wood. For a plaque—the simplest way to get started—choose a piece of wood cut to shape that has no dents or other surface flaws and sand it smooth with #400 black wet-or-dry sandpaper. If you plan to paint it, first apply a wood sealer. If you stain it, omit this step and proceed with the staining, following the instructions on the container.

Once the wood is painted or stained, seal the surface with a spray of clear wood finish. When it is dry, the piece is ready for application of the design.

✦ This purse is a good example of how decoupage can be used to decorate trays, boxes and other small articles.



Select your design from almost anywhere. It can be gift wrapping paper, a postcard, an engraving or print, a clipping from an art book. Do not use magazine clippings until you gain experience. The inks used to print magazines tend to bleed. Seal the sheet of paper by spraying with three or four coats of clear wood finish.

Cut out the part you want for your decoupage, a bunch of flowers, a human figure or fruit, for example, using good quality cuticle scissors. Turn the work past the scissors as you cut. Do not move the scissors. If you leave a white edge at any point, disguise it with a felt-tipped pen of appropriate color.

If you want to mount a whole print, poster or document, of course, you won't need to cut it.



▲ Making a simple plaque. Start with a board that is free of surface flaws. Sand it smooth.

Apply paste to the back of the paper with your fingers. Buy a good quality wallpaper paste for this purpose. Do not use wheat paste. Alternatives are decoupage paste, available in hobby shops, and white glue.

Place the paste-coated paper in position

on the plaque. Cover it with a few layers of slightly damp paper toweling and roll it with a rolling pin, working outward from the center in all directions to force out excess glue and air bubbles. Turn the paper towels and continue rolling several times. When all the air has been rolled out, wipe off the excess glue and observe the work for three minutes or more. If any air pockets return, prick them with a pin and press them down with your fingers to force out the air. When you are satisfied that no more air remains beneath the paper, allow the piece to dry for 24 hours.

When the work has dried, seal it with the spray sealer and wait 30 minutes or so for the surface to dry. Then brush on a coat of clear interior semi-gloss wood finish in even flowing strokes with a one-inch sable brush. If the piece has deep sides, as a box would, coat the sides first and the top last to prevent runs. Let it dry, wipe the piece with a lint free rag or tack rag to remove all dust and coat the piece again.

Apply enough clear wood finish in this manner—usually about 10 or 12 coats—to sink the design. Do not sand between coats, unless it is necessary to remove an embedded speck of dust.

When the piece is coated, make a solution of water and just enough detergent to form suds and wet-sand the surface with #400 black wet-or-dry paper to reduce the surface of the finish over the paper to the level of the surrounding surface. Don't use a sanding block; it's too easy to sand too deeply and you lose the "feel" that will let you know when the surface is flush.

Wipe off all residual moisture and any possible grit from the sandpaper and inspect the work to make certain the surface is even. Then, apply three additional coats of clear wood finish. Polish the final coat with 0000 steel wool, rubbing with the grain of the wood.

In addition to the basic method, there

are techniques that can give the decoupage piece an aged look. With an old poster or document, for example, this can be achieved by charring the edges in a candle flame or by tearing the edges of the work rather than cutting them.

When charring a piece, keep a moist paper towel handy to snuff out a flame before it burns too far. Use your fingers to remove burned portions before sealing the work and applying paste.

The best way to tear the edges of the paper you wish to apply is to hold the work face up, holding it in one hand and tearing pieces away with your other hand. This provides a soft edge with a worn look.

The wood surface itself can be distressed by beating it with a length of chain or scarring it with a rough file or any other object that will damage its surface lightly in a random way. Some hobbyists char the wood in a charcoal fire or with a torch.

Another possibility is to use an antiquing glaze over the completed decoupage.

Naturally, decoupage can be used to decorate more than flat plaques of wood. The large number of possibilities includes walls, unfinished furniture, trays, jewelry boxes, china, and wastebaskets.

Wooden purses and boxes can be purchased in hobby stores, as can appropriate hardware.

If you wish to line a box with paper, first give the interior a coat of paint. Then, give the paper a coat of clean finish, allow it to dry and cut it to fit. Put a dab of white glue on each piece and spread the glue with a damp sponge. Press the paper into place, rubbing it with a piece of balled up waste paper. Dry the work for 24 hours, then apply six coats of clear finish, polishing the last coat with 0000 steel wool.

For a fabric lining, cut cardboard pieces to fit and glue them to the cloth. Cut the fabric at the edge of the cardboard, allowing 1/2-inch extra fabric at the top edges



▲ Spray the board with an aerosol semi-gloss clear wood finish to seal it before painting. If you intend to stain the board omit this step. In either case, give the board a sealing coat after it has been painted or stained.



▲ Give the design you intend to mount three coats of the aerosol finish, spraying lightly each time.



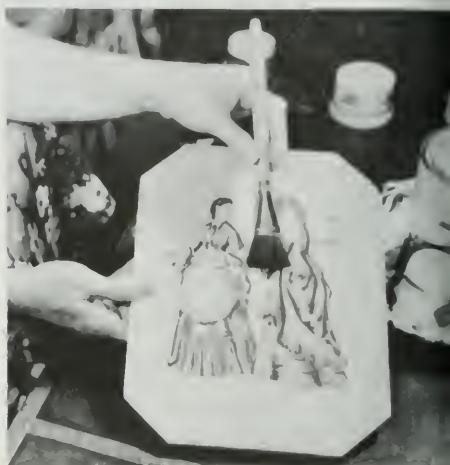
▲ Cut out the form with cuticle scissors, turning the work past the scissors.



▲ Apply paste (see text) to the back of the design with your fingers.



▲ Apply glued paper to plaque and cover it with several damp paper towels. With a rolling pin, roll outward from the center in all directions, forcing out air bubbles and excess glue.



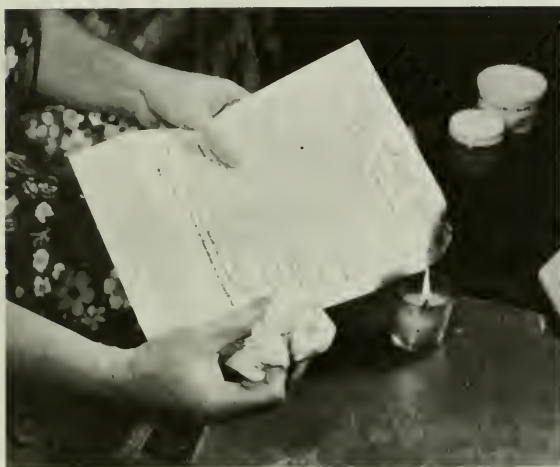
▲ After the paste has had at least 24 hours to dry, seal the surface with the aerosol finish and let it dry for half an hour. Then brush on the first coat of clear semi-gloss finish.



▲ When the piece has received enough coats of finish to sink the print (usually 10 to 12) sand the surface over the print down flush with the rest of the surface with #400 black, wet-or-dry sandpaper. Sand it wet, using a mild sudsy detergent solution, wipe it clean and allow it to dry for 24 hours.

▼ Apply three final coats of clear finish to the leveled surface. After the last coat has dried, polish it with 0000 steel wool, rubbing with the grain of the wood. Apply decorative hardware, and the plaque is complete.



How to Decorate with Decoupage

✦ *Charring the edges of a document to achieve an old look. Hold a damp paper towel in one hand to snuff out flames that burn too far.*

of the side pieces. Fold this excess over and glue it to the reverse side. Spot glue the fabric covered cardboard pieces into place.

The box can be covered with several decoupage forms or with one large sheet. Paint it first. To cover it with a single sheet, coat the top of the box with glue and center the sheet on it. Be sure to spray the sheet first with clear finish. Roll down the sheet on the top, then fold it down on each side, pinching it together at the corner to form wings. Fold the corners back and forth several times.

When the box has dried, trim off the wings at the corners and the excess paper at the edges and give the box at least six coats of clear finish.

China should receive a coating of clear finish before the decoupage work is applied.



➤ *Crumble off burned portions with your fingers.*



◀Realistic flying decoy even flaps wings with a little encouragement from the wind. Materials, below, are similar to those needed for basic cork decoy; just add plastic wastecan. ▼

Make a Flying Decoy

Use this old-time hunter's
ruse to bring down high-
flying waterfowl

OLD TIME MARKET hunters and waterfowling guides from New Jersey to Illinois used flying decoys to draw the attention of high-flying ducks to their floating decoy spreads. Flying mallard decoys were manufactured commercially during the 1920s and, at the turn of the century, flying brant decoys were made for use on the famous gunning waters near Tuckerton, N. J.

The old-time decoy makers used the materials which were available around them so, following this tradition, you can use materials that are near at hand.



Scrap pieces of one-inch thick cork wall-board are readily available from lumber yards. For the decoy head, use a block of balsa wood. A soft-plastic waste paper basket provides the natural curve which perfectly imitates the set wings of a decoying duck.

A few hours of work with a wood rasp and paint brush are all that are needed to create the finished product—a flying drake redhead decoy.

The redhead is a good choice because this colorful duck shows up well against the drab marsh surroundings. The purpose

deep-vee sea angler: see boat building projects

degaussing: see color television

dents: see repairs, automobile

depth of field: see photography

desk, modern: see furniture, indoor

Make a Flying Decoy

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▲ Balsa head, above, is fitted with dowel to body. Free-flowing wing is cut with scissors, and glued in body slot, right. Construction is shown in more detail below. Make sure that the wing slots and neck dowel are set at the proper angle for a realistic appearance and for balance. ▼





◀ Left, decoy takes shape. Note alignment of head, body and wings. Final construction step is painting, below. Decoy should stand out from drab surroundings; but pick species common to your shooting area. Find balance point, left bottom, and use wire or thin rod for flexible base. ▼



of a flying decoy is to attract high-flying ducks to your other decoys, which otherwise might not be seen because they blend in with the surrounding marsh grasses.

Other species which would show up equally-well against drab vegetation include



drake canvasback, drake scaup, drake goldeneye, drake bufflehead and snow goose. When you make your flying decoy, choose a species which is common to your gunning area.

Where there is a great variety of species throw out 50 diver and puddle duck decoys, separated by an open space of water. Set the flying decoy on a pole, off the tail end of the diving duck decoys. It seems to attract the attention of both diving and puddle ducks.

S.M.M.

See also: DUCK BOAT; HUNTING.

Making Your Own Decoys

A good decoy spread can be costly, unless you make it yourself. The simplified method used here speeds the work and uses inexpensive materials

FEW WATERFOWLING experiences are more satisfying than watching a pair of high-flyers bypass other blinds and set their wings to drift straight into your rig of homemade decoys.

To the tradition-minded duck hunter, most factory-made decoys are merely lackluster items of equipment which get the job done more times than not. But there's no substitute for a set of well put together decoys designed for your own special needs.

Hand-carved decoys are more effective on ducks than plastic imitations, and they're also more pleasing to the gunner's eye.

Ideally, your decoys should be made of natural materials and designed for the special gunning conditions in your hunting area. A good rig of homemade decoys will last throughout your gunning years and remain as treasured objects to pass on to future generations.

Your first consideration is to represent the species which are most common to your area. If you live on the Atlantic coast, chances are that the most common puddler is the black duck. In the midwest, the mallard is king. Further west, pintails are



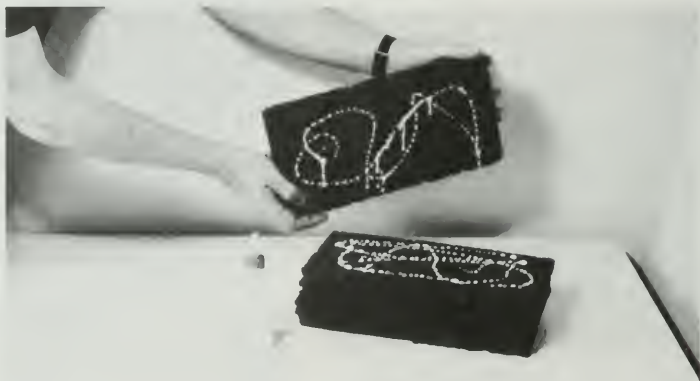
the most sought-after ducks. Wood ducks, teal, widgeon, gadwall and most other puddlers will decoy to black duck, mallard and pintail decoys.

If you hunt on big bays, lakes or rivers you may wish to make a dozen or more puddler decoys. On many marshes, however, a half-dozen decoys is adequate. Some experienced gunners claim that a pair brings more shooting than a spread of several dozen decoys. These men reason that puddle ducks rarely see large flocks along heavily hunted shorelines during the season. Thus, the ducks decoy more readily to a set of two or three blocks.

If diving ducks provide shooting in your area, you'll also want to make a rig for these birds. It's likely that bluebills are the most abundant divers where you hunt. Or perhaps you're situated in a canvasback or redhead flyaway. In any case, a good "starter" rig is an even dozen decoys which



◀ Materials for decoys are: drill, 2- or 3-inch redwood or white pine, coping saw, paring knife, wood rasp, waterproof glue, decoy paint, cork and marine plywood. After creating good model body and head patterns, transfer them to wood or cardboard for reference. ▼

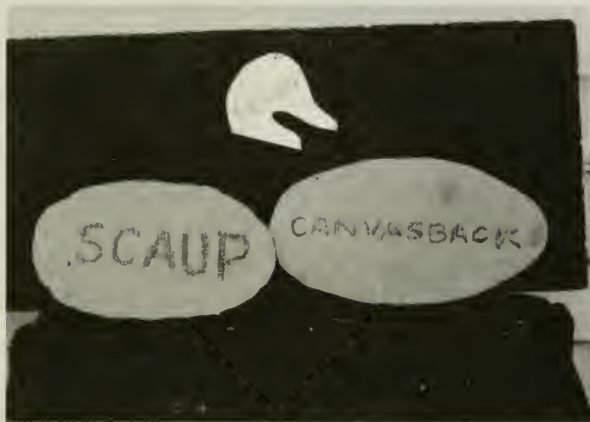


represent the species most common to your area. Later on you may wish to build your number of diving duck decoys to 30 or more. Diving ducks like plenty of company.

When you begin to see geese over your favorite blind, it's time to consider adding a pair of goose decoys to your set. Often, goose decoys attract ducks to your spread besides bringing in a stray honker or two. If geese are abundant where you hunt, it

may be worth your effort to make a complete set of a dozen goose decoys.

Besides your basic rig of puddlers and divers, you may wish to consider making a few pair of special purpose decoys. In some areas, for example, buffleheads are abundant during some years. These ducks sometimes furnish shooting for days at a time when other species leave the area. Buffleheads, however, have a tendency to



◀ Use of plenty of glue when gluing cork sheets together. White glue can be used for flying decoys, waterproof glue should be used for floating birds. Weigh down built-up block with books, bricks or other heavy object for 24-hours to insure good bond.

land outside the bluebill spread. Simply make a pair of bufflehead decoys and add them to the bluebill rig. From then on, the buffleheads will swing in close and furnish some fine shooting.

Special purpose decoys, whether they're buffleheads, canvasbacks, brant, wood ducks or widgeon, often spell the difference between a good shoot and returning home empty-handed. Set them in a conspicuous position off to one side of your other decoys, where they can be effective.

For most of today's gunners, the most functional models are cork decoys with wooden heads. Cork is easy to work with and the necessary tools are few and inexpensive. Also, cork decoys are lightweight compared with wooden models. You can carry a dozen cork blocks with relative ease and on the water they ride high and naturally. They rarely overturn in high waves and wind.

Cork decoys are sturdy and easy to repair. They absorb punishment year after year, and the rough appearance of cork simulates the feather patterns of live ducks.

The most direct way of obtaining cork is to consult the Yellow Pages of your tel-

ephone directory under "Insulation Materials." Buy the cork from the largest supplier in your area for the best price savings.

It's best to purchase large chunks of cork rather than one-inch layers which will demand quite a bit of glue. But if large chunks of cork are hard to come by, don't hesitate to buy the cork in any available, workable form.

With a little luck and thought, however, you may be able to obtain cork at no cost. Generations of Long Island hunters have made decoys from cork found in abandoned life preservers.

Other good sources of cork are old freezer or refrigeration plants which are being torn down. Cork is a common insulation material, and an old meat freezer may hold chunks large enough for solid goose decoys.

Besides cork, your basic decoy-making materials are:

Marine plywood, 1/2- to 3/4-inch thick. The plywood serves as a baseboard that is glued to the bottom of your cork decoy.

Brass wood screws to fasten a lead keel to the plywood baseboard.

Sheet lead, obtained from a plumbing supply store, is used for keels. Compared with factory-made lead keels, sheet lead is inexpensive. It's easy to cut with a paring knife.

Redwood or white pine, two- or three-inch stock for carving decoy heads.

Casein waterproof glue for gluing layers of cork and for fastening the plywood baseboard to the decoy body.

Wood dowel for attaching the decoy head to the body.

Paint, black, white and brown are the basic colors. Many decoys, particularly bluebills and other diving duck blocks, can be painted with these three colors or a mixture of them. Purchase basic colors in quarts or gallons at your local paint store; get nongloss exterior paint.

Glass eyes are available at some sporting goods stores.

A few inexpensive tools will serve you well. You'll need a coping or keyhole saw for cutting the decoy head and marine plywood baseboard. A wood rasp for shaping the head and body of the decoy, and a drill for making dowel holes.

After you've gathered your tools and materials, buy or borrow a decoy to use as a model. A very good alternative is to work from basic decoy patterns.

First assemble the cork. If you have a chunk of cork large enough for an entire decoy, simply cut the cork into a rough outline of the decoy body and glue the bottom to a cut-out piece of marine plywood baseboard.

If several layers of cork are needed, glue them together and proceed with the steps outlined above. Apply the glue generously and allow the decoy to set overnight. Bricks or other heavy weights set atop the roughed-out body will insure a good bond.

For good stability, your decoy body should be half as wide, at its widest point, as it is long.

After the glue has dried, use the wood

rasp to carve out the final shape of the body. As long as you're sure of the final shape you want, this is a fast and easy job.

Use the saw to cut the head shape from the redwood or white pine. The grain of the wood should travel lengthwise from the bill to the back of the decoy head.

Use your wood rasp for the final details of the head. The top of the head and the cheeks may be left puffed out. The neck and the eye patches should be indented. Pay attention to the duck bill. Beware of making it too short. Keep referring to your model decoy.

Next, drill a hole in the bottom of the decoy head for the dowel. Drill three-quarters of the way toward the brow of the head.

Now, insert the dowel in the decoy head and measure the protruding end of the dowel to insure that it travels through the decoy body until it almost meets the plywood baseboard. Smear glue on the dowel and glue decoy head to the body. Tightly clamp the head to the decoy body and allow the glue to set overnight.

Apply liberal coats of paint when you paint your decoy. Refer to color identification charts in waterfowl booklets.

After the paint has dried, drill eye holes and glue in the glass eyes. Now cut a breast-to-tail length keel from the sheet lead. Fasten the keel to the decoy body with rubber bands and test-float the decoy in your kitchen sink or bath tub. If the decoy lists to one side, rearrange the keel until the decoy rides perfectly upright. Mark the proper keel position with a pencil and fasten the keel to the plywood baseboard with two brass screws. A third hole may be drilled in the breast end of the keel for an anchor cord.

Your decoy is now ready for use. Once you make a couple of decoys you'll find ways to cut your working time in half. One shortcut is to make several or a dozen decoys at the same time. It's a lot quicker,

➤ Once the cork block has been assembled, rough shaping with a rasp can be done. If there is much cork to be removed, you can use a sharp knife for cutting; then shape with rasp.



◀ Lightweight balsa is a good wood for flying duck decoy; redwood or pine is used for floating decoys. Use coping saw or keyhole saw, left, for basic shaping of head. Hen shoveller decoy, foreground, below, needs only strip of sheet lead for keel; rough water scaup decoy, rear, uses wooden keel and lead. ▼

for example, to glue or paint a dozen decoys at one time than going through the separate steps with each one.

Once you complete a couple of decoys and get the knack of it, you may be pleasantly surprised at how little time it takes to produce these fine-looking additions to your waterfowling gear.

S.M.M.

See also: DUCK BOAT; HUNTING.

WHERE TO FIND IT

Glass eyes and paints in specialized colors may be purchased from Herter's, Waseca, Minn. 56093.

Basic decoy patterns and color charts can be found in such books as *Duck Decoys* by Eugene V. Connell and *Wild Fowl Decoys* by Joel Barber.



Build an Antiqued Secretary Desk

Second hand lumber, even crate wood, can be used in this desk because the antique finish will cover any flaws

YOU COULD PAY more than \$200 for a ready-made secretary-desk like that above—or you can build it in your home workshop for not much more than \$20.

The economy trick is largely in the gold-antiqued finish that conceals surface flaws so completely you can use board grade or even second-hand lumber in the construction. All finishing materials, even the cloth pads for blending and texturing, are supplied in a nationally-available kit.

To begin, round up as much scrap board and used lumber as you can to fill out the items specified in the Materials List. Edgetrim and sand any old lumber going into the job. You need not get it smooth, just free of rough fibers. Squeegee a spackling compound over any pits; the antiquing process will hide this filler completely.

Cut the sides, tops, and bottoms of the upper and lower units, making certain the ends are square. The backs may be plywood or tongue and groove (T&G), though it's a good idea to use plywood for the back of the lower unit to insure rigidity, as the weight of the upper unit rests on it.



Use an original corner of the plywood panel for one of the cabinet corners and you'll square it immediately. Fasten all lumber-to-lumber joints with 8d finishing nails; sink the heads and spackle them flush. If 1/4-inch plywood is used for the back, install it with 1-inch brads. Try a gap-filler glue such as casein or aliphatic resin to reinforce the joints.

Preparing doors. Rim the lower doors with 1 x 2 stock on all sides except where the hinges will go. There, install 1 x 3 to allow the door to overlap the cabinet side.

Upper doors are made from stock screen frame. Recess an inside edge of the stock 1/4-x 3/4-inch and cut the horizontal and vertical frame pieces. Lay out the mitered framing and attach with corrugated fasteners.

Instead of screening, cut 3/4-inch welded wire mesh on the diagonal to fit the rab-

Build an Antiqued Secretary Desk

bedded area of each top door. A few shots from your staple gun will anchor the mesh, then run casein or aliphatic glue along the channels to lock it firmly all around. The diagonal position is not only decorative but it also braces the doors.

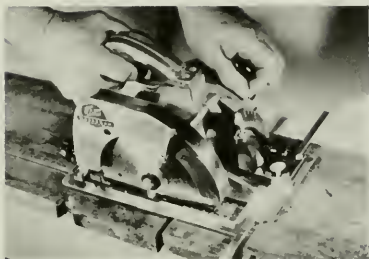
There's a simple trick to shaping the rounded upper portion of the doors. Merely cut a circle from scrap plywood and then use the cut off sections in the doors. Fasten the plywood fillets in place at upper corners against the wire mesh using 6d finishing nails through their tapered ends and glue along the edges. Conceal the seams with a spackling compound. Use corner plates to stiff the doors at their lower corners, corrugated fasteners at the upper corners.

Desk lid supports slide out automatically through front guide holes when the lid is opened; return when it is closed. Two long screen door springs connected to these slides by a chain provide the locomotion, doing away with any carefully fitted metal levers.

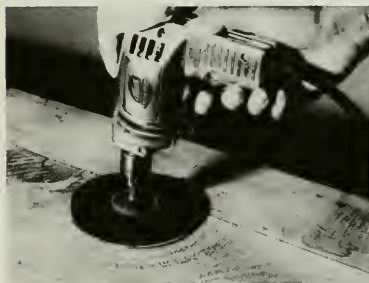
After installing the channel bottom in the lower section and cutting and fitting the writing top, insert the support slides and check them for proper fit. Attach a long shank screw eye on the top of each slide about 4 inches from the inside end and on one side so that it will ride along the recessed side of the writing top. Install a standard 5/8-inch diameter bead chain sprocket on each recessed edge of the writing top about 1-inch in from the end.

Now, attach 1/8-inch bead chain to the inside of the lid 4 inches from the hinge, using a small staple or screw eye. Feed the chain through the long-shank screw eye on the slide, pass it over the chain sprocket and down in back to the screen door spring. Clinch the screw eye over the chain to lock it. With lid closed, attach chain to spring with moderate tension.

As you open the desk lid, the screw eye will slide forward in its slot and the chain



▲ *Used lumber is cheap way to obtain sturdy material for an antiqued project. Just square up the edges.*

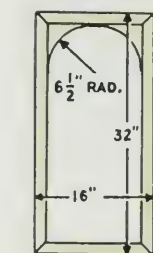
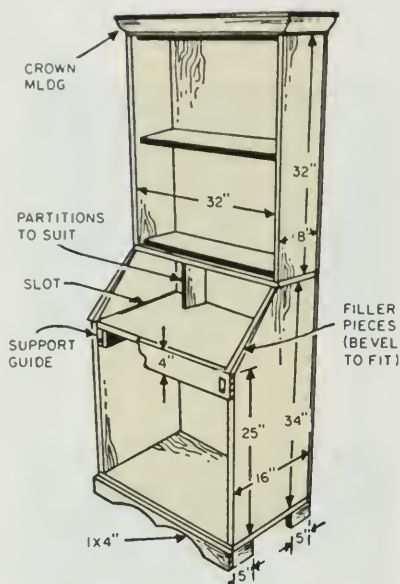


▲ *Since the finish will hide flaws in the wood, a light sanding, followed by squeegeeing spackling into the deeper pits, will do for the roughest surfaces.*



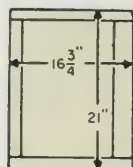
▲ *Make both sections at the same time to be sure they match in width. Favor plywood for back of lower unit; tongue and groove boards can be used for upper half.*

Build an Antiqued Secretary Desk



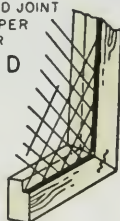
C UPPER DOOR

DOOR DETAILS



A LOWER DOOR

MITERED JOINT FOR UPPER CORNER



DOOR FRAME OF SCREEN STOCK MITERED CORNERS CORRUGATED-NAILED AT UPPER CORNERS

B PLAYWOOD RECESSED 3/4" ON HINGE SIDE



should slide the support until it is fully extended. Close the lid and the slide should retract out of sight. If any adjustment is needed, increase or decrease the spring tension. Once this is set correctly, cut off excess chain and hook up the other slide in the same manner.

Shelves in both upper and lower units may be placed to suit your individual needs. If reinforced with glue and held by 6d finishing nails driven through the sides, no cleats are needed for normal loading.

Applying the finish. Completion of the cabinet in used and scarp wood would appear to present a tedious and expensive finishing problem. The secretary-desk, however, was transformed into a fine piece of furniture with materials obtained in an antiquing kit.

If you wish to do the job as it was done in the photos, choose white as a base color. Stir the base paint and apply, after making sure the surface is clean and dry. Some of the used lumber may already have paint on it. You can go over this if you first sand off the gloss.

One coat of paint is usually enough. If the wood is badly blemished, add a second coat; let it dry before you start antiquing.

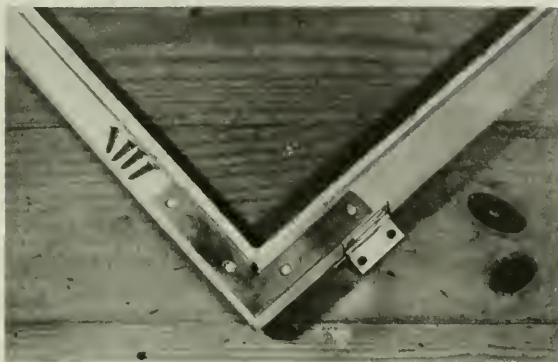
Antique gold is brushed on after the base paint has dried overnight, it's not a gilt and not intended to cover like one. The base color will be partially visible through it. While the brushed-on gold is still wet, gently wipe the central area of the panel so the outer rim area will have a heavier coat. A subtle gold luster will still remain over the whole area.

Work only one panel at a time. Use the cloth pads from the kit to create any effect you want, using a patting or swirling motion and a light touch to blend out the gold and eliminate any brush marks. Stir the gold frequently while you work to keep the gold metallic particles dispersed through it.

If you prefer a wavy or stippled pattern, use the pads to create it. There is no set

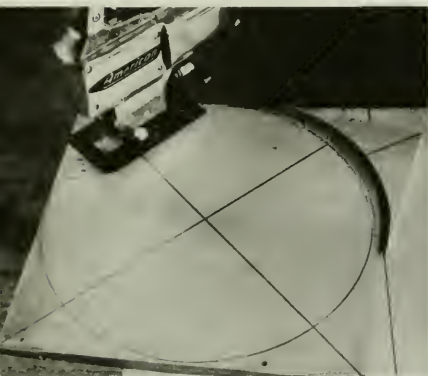
Build an Antiqued Secretary Desk

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◀ For stiffness, strengthen lower corners of upper doors with corner plates. Corrugated fasteners, reinforced by curved sections, will hold miters at upper corners.

▼ With spackling compound fill in every crack and seam that remains after gluing and nailing each curved section in place. Final finish hides touch-up.

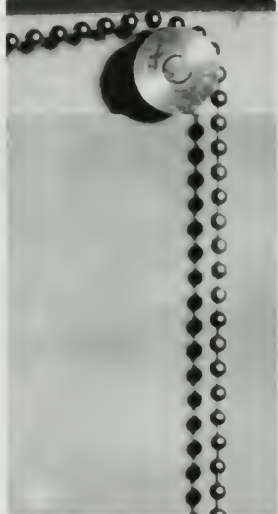
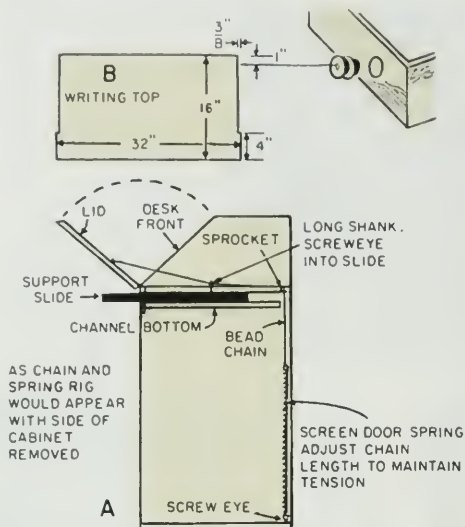


▲ Here's an easy way to get curved sections for rounding the door tops. Cut a circle from a square equal to the diameter needed. Use the cut off corners.



➤ Best way to install lid and doors is by fitting and trimming on the job before final assembly. Top molding isn't on yet.





◀ Bead chain operates writing lid supports and runs over standard bead chain sprockets at rear of slots in writing top. Screen door springs attached to lower end of chains (moderate tension) pull supports back when lid is closed. ▶



▶ First step in finishing is application of base paint with brush in the conventional manner. If second coat appears necessary, let the first one dry overnight.



▶ Next, brush on the gold antiquing and wipe it off the central panel areas. A gold luster is left over the entire surface; remains more prominent around the rim.



➤ Finally, when the gold has completely dried, cover the whole piece with a coat of crystal clear liquid vinyl laminate to make it scrubbable and ring-proof.

Build an Antiqued Secretary Desk

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style for antiquing. The finest examples represent the preference of the craftsman who produced them. So you use your own ideas. Take plenty of time to work as the gold dries slowly, and you can add more after the first coat dries. Let it deposit in the crevices of moldings for emphasis.

Don't aim for a straight-lined mass-production look. The beauty of an authentic antiqued finish is in its individuality.

The vinyl liquid laminate goes on after the gold has dried overnight. This is the crystal clear coating that makes your antiquing job completely scrubbable. And wet glasses won't leave rings on it. One coat is enough but if you want a higher luster you can add another coat after the first one has dried overnight.

See also: ANTIQUING; FURNITURE, INDOOR; WOODWORKING.

MATERIALS LIST

Quantity	Size and Description	Purpose
4	1" 8"x32" used or scrap wood	top unit and rear writing surface
4	1" 8"x34" used or scrap wood	bottom unit sides
5	1" 8"x33 1/2" used or scrap wood	top and bottom of lower unit, and desk lid
4	1" 8"x21" used or scrap wood	door panels, lower unit
2	1" 4"x33 1/2" used or scrap wood	base front and cross member above lower doors
1	1" 4"x24" used or scrap wood	base side
2	1" 4"x16" used or scrap wood	lid support channels
2	1" 4"x17 1/2" used or scrap wood	lower door rim
4	1" 2"x16 3/4" used or scrap wood	lower door rim
2	1" 2"x17 1/2" used or scrap wood	lower door rim
4	1" 2"x32" used or scrap wood	vertical frame, upper doors
4	1" 2"x16" used or scrap wood	horizontal frame upper doors
2	1" 2"x16" used or scrap wood	lid support slides
1	1/4" 33 1/2"x35 1/2" plywood	bottom unit back
1	1/4" 33 1/2"x32" plywood	upper unit back
1	1/2" 13 1/4"x14 1/4" plywood	upper door top corners
1	5"x5' crown molding	top unit
2 yds.	36" welded mesh	upper door grilles
2	screen door springs	lid support slide returns
2	5/8" bead chain sprockets	lid support slide extensions
1	1/8"x60" bead chain	lid support slide extensions

NOTE: Also need 6d and 8d finishing nails, 1" brads, screw eyes, casein or aliphatic resin glue, spackling compound, hardware and antiquing kit.

Do-it-yourself Colonial Desk

This easy-to-make desk would enhance the surroundings of any den or study, regardless of present decor



DESKS APPEAR in a wide variety of sizes, shapes, and materials, but you will have to look far and wide to beat this Colonial-type desk.

Before starting construction, study the accompanying plan carefully. All dimensions and type of stock are indicated. Check the Materials List and be sure you have everything on hand for the job. Make a pattern that can be placed on the stock.

Start by drawing the pattern onto heavy paper on which 1-inch and 2-inch grid squares are drawn. You can simplify this by ripping a strip of wood, about 26 inches long, to a 2-inch width. This makes it easy to then locate guide lines for the squares. When the squares are completed, outline the contours for the various parts, as shown, to obtain a full-size pattern. The same procedure is followed for parts calling for 1-inch squares on the plan.

Note that each leg is made of two pieces of $\frac{1}{2}$ -inch birch plywood, glued together to form a single 1-inch thick leg. This means you must cut out four pieces to plan size and contour to make the two legs.

The two foot pieces are formed in the same manner, except that $\frac{3}{4}$ -inch thick birch plywood is used instead of $\frac{1}{2}$ -inch stock. Note that $\frac{1}{2}$ x 8-inch recesses are cut in each piece, making a 1 x 8-inch slot when the foot pieces are glued together. The slot is to permit the recessed bottoms of the legs

to be inserted into the foot pieces for assembly. Cover all exposed plywood edges of the legs and feet with matching flexible wood trim.

Having inserted the legs in the foot pieces (glue them together later), the next step is to make the cleats that are positioned at the top of each leg on the inside surface (see plan). These two cleats are made of 15-inch lengths of 1 x 1-inch scrapwood with the ends shaped to the top contour of the leg pieces. They are attached to the legs with glue and #8 x $1\frac{1}{2}$ -inch flat head wood screws.

Triangular-shaped 6-inch cleats (scrapwood) are centered and attached in the same manner to the inner side of each leg at points 5 inches above the floor line. These serve as supports for the contoured lower brace. All screw heads should be covered with screw-hole plugs, as shown. The exposed plywood edges should be covered with the flexible wood trim to enhance appearance, as in the case of the legs and feet.

After the upper brace has been put in place and attached to the cleats at the top of each leg, it is time to attach the desk base. This is cut to plan size from $\frac{3}{4}$ -inch fir plywood and attached to the square cleats and the upper brace part with glue and #8 x $1\frac{1}{2}$ -inch flat head wood screws.

Two dividers made from $\frac{3}{4}$ -inch birch plywood and cut to $3\frac{3}{4}$ x $23\frac{1}{2}$ -inch size

are attached to the desk base with glue and #8 x 1½-inch flat head wood screws at the points indicated on the plans. These are part of the lower drawers assembly. Stops for the lower drawers can be made from scrap plywood and should be attached to the desk base with glue and brads. Three 13¾-inch scrap pieces will be needed to fit in place between the two dividers at a point 16 inches in from the front edge of the desk.

A "pigeonhole" type assembly is used to form the upper drawers, resulting in a 5-drawer unit. The entire assembly is made from ½-inch birch plywood, including the six 3 x 6¼-inch dividers which are set at equal distances apart. Assembly calls for glue and 3d finishing nails. Set the nail heads and cover with matching wood filler. Cover all exposed plywood edges with flexible wood trim.

The "pigeonhole" upper drawers assembly is attached to the desk top, which is cut to a 23½ x 42-inch size from ¾-inch fir plywood. Glue and #8 x 1-inch flat head wood screws are used to attach the assembly to the desk top. The top is then attached to the lower drawer dividers with

glue and 4d finishing nails. Set the nail heads and cover with wood filler.

Having cut the desk side pieces to plan size and contour from ½-inch birch plywood, the next step is to attach plywood spacers to each side piece to form ends for the lower drawer compartments. The spacers are cut from ¼-inch fir plywood and are 3¾ x 16-inch. Glue and brads are used to attach the spacers to the side pieces.

The contoured 42-inch desk back is attached to the side pieces, the desk top, desk base, and upper drawer unit with glue and 3d finishing nails. Cover the nail heads with wood filler and cover all exposed plywood edges with flexible wood trim.

The upper and lower drawers are typical box-type assemblies. Fir plywood is used, the upper drawer fronts being made of ½-inch stock, while the lower drawer fronts are of ¾-inch stock. Sides and backs are ¾-inch hardboard. Glue and 3d finishing nails are used to assemble the drawers. All dimensions are shown on the plan.

Sand and finish the desk as desired.

Original design by Steve Ellingson.

See also: FURNITURE, INDOOR; FINISHING, WOOD; WOODWORKING.

MATERIALS LIST

Quantity	Size and Description	Purpose
1	¾" 48"x48" birch plywood	foot pieces
1	¾" 24"x48" fir plywood	base
1	½" 48"x96" birch plywood	legs and back
1	¾" 24"x48" fir plywood	drawers
1	¼" 12"x24" fir plywood	spacers
	½" 24"x48" hardboard	drawer bottoms
1 roll	2" wood trim	
6 rolls	1" flexible wood trim	
10	½" screwhole plugs	
as needed	#8x1" flat head wood screws	
as needed	#8x1½" flat head wood screws	
as needed	#8x2½" flat head wood screws	

NOTE: Also need 3d and 4d finishing nails, wood filler, glue, contact cement, sandpaper, drawer pulls, furniture glides, and scrap lumber for cleats.

Build a Corner Desk Set



This home office and space saver is a lot simpler to build than it looks

MODERN HOMES and apartments where space is limited, need to put their corners to as practical a use as possible. The four-piece corner group shown here is an excellent example of how to use a vacant corner. It is attractive, relatively inexpensive, and simpler to build than it looks. The desk top and two bookcases are built individually, then fastened together as a unit, and the whole assembly is on concealed casters to facilitate housekeeping. The hanging corner cabinet may be used for office supplies or knickknacks.

To facilitate building, make up full-size patterns from the drawings. Plywood is used for all major panels, and the patterns can be traced directly onto the wood.

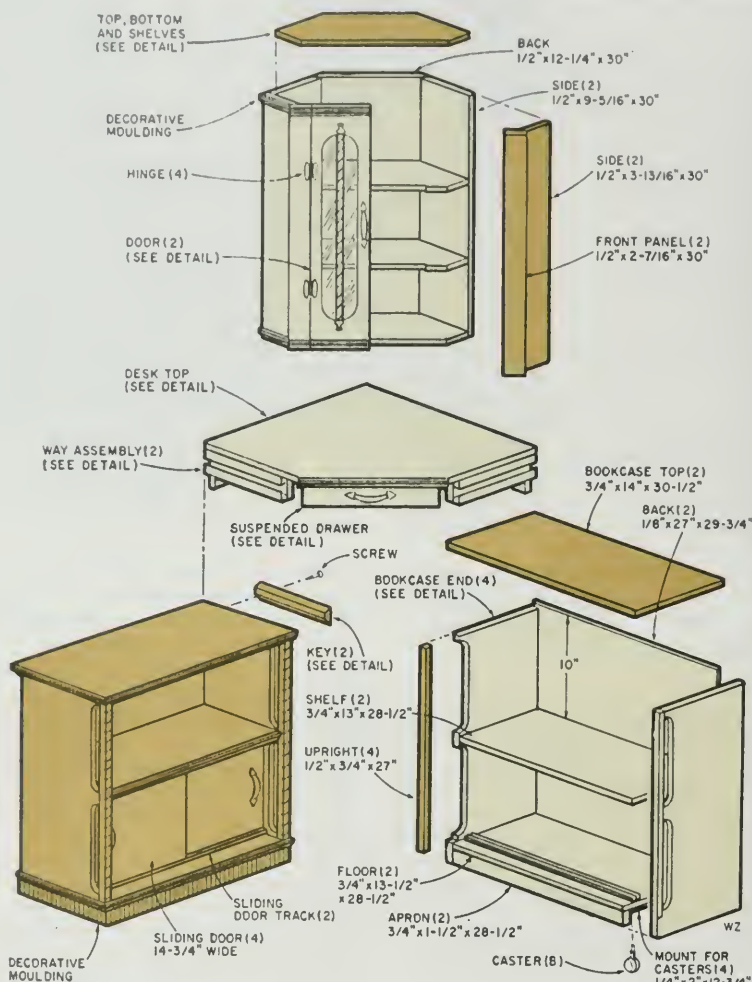
Two things combine to give the finished

project a really professional appearance. One is flexible wood tape, which you get to match the veneer of the plywood of your choice. It's used to cover all exposed plywood edges. The other handy help is the wide variety of decorative molding available from your building supply dealer or lumber yard.

Start by cutting out and assembling the corner cabinet. Top and bottom pieces are identical, as are all the shelves. Use glue and finishing nails.

Note: in all construction of this project, set nail heads slightly below the surface, cover with wood putty, and sand smooth. Be sure to coat all mating surfaces with glue in order to achieve maximum joint strength.

Install as many shelves as desired. Set each at the required height, and fasten in place with finishing nails driven through from the outside. Cover the exposed edges of the top, bottom, and shelf pieces with wood tape. Now install the two narrow front pieces, and sand their outer edges



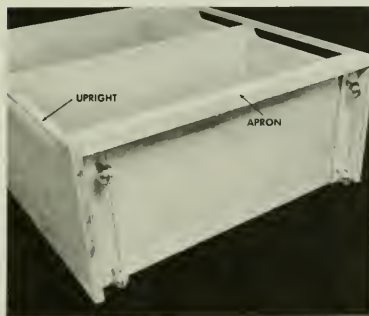
flush with the side pieces. Cover the exposed edges with wood tape.

Cut the two door panels out of $1/2$ -inch plywood. It is suggested that the two panels

be clamped together to cut out the inside sections in order to get an exact match. Sand these inner edges smooth, install the $3/4$ -inch wide strips of $1/2$ -inch plywood as



▲ Parts A, B and back are shown assembled to complete the basic cabinet. Top and bottom pieces are identical in size.

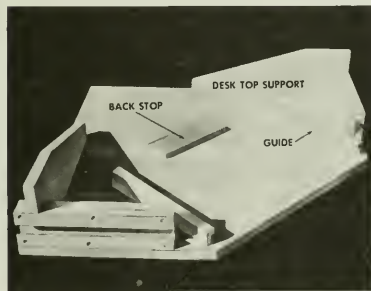


▲ Underside of bookcase showing installed casters, front apron, uprights. A $\frac{1}{4}$ -inch plywood mount is used with casters.

➤ Assembled drawer shown right-side-up. Note slide along outer top edge of drawer side. Attach with glue and small brads.



▲ Bookcases and corner desk top are held together with "keys" and "ways." An assembled key and way is shown at left.



▲ Underside of desk top, with "ways" attached. Desk top supports, guides for suspended drawer and back stop also shown.



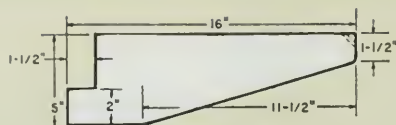
center strips, and cover the exposed edges as noted on the plans. The center strips must be flush with the panels, and they are edge nailed into place at the top and bottom, as shown in the drawing.

Fasten the ornamental trim to the center strips, and the decorative molding strips to the top and bottom of each door, and the cabinet itself. Use glue and small brads. Mark and drill pilot holes for the screws used for door handle and hinge attachment.

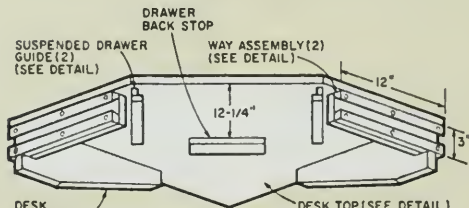
Make up the two bookcase units next. Clamp the four side pieces together to cut out and fair the curved surfaces, in order

to get an exact match. Fasten the bottom panels and the shelves between the end panels, with glue and with 6d finishing nails driven through from the outside. The top panels are mounted on the tops of the side panels in the same manner. Note that one top panel must have a 1/2-inch overlap on the right side of its bookcase, and the other top panel must have a 1/2-inch overlap on the left side of its bookcase.

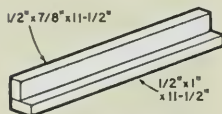
Install the apron across the bottom front of each bookcase, and the two uprights on each. Install casters that will bring the bottoms of the bookcases 1/4-inch off the floor.



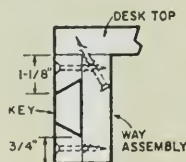
DESK SUPPORT (2)
3/4" PLYWOOD



DESK-BOTTOM VIEW



**SUSPENDED
DRAWER GUIDE (2)**

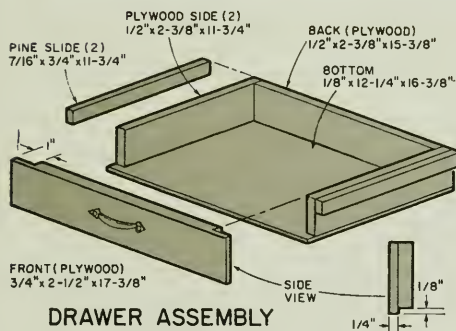


**WAY ASSEMBLY (2)
AND KEY (2)**
3/4" BIRCH

MATERIALS LIST

Quantity	Size and Description	Purpose
1	3/4" 4'x8' birch plywood	major panels
1	3/4" 4'x4' birch plywood	major panels
1	1/2" 4'x8' birch plywood	cabinet and door panels
1	1/8" 4'x8' tempered hardboard	drawer bottom and bookcase back
1	3/4" 3"x4' solid birch	way and key assembly
3	1" rolls flexible wood tape	
as needed	#8x1 1/2" flat head wood screws	
as needed	#8x1 3/4" flat head wood screws	
as needed	#8x2" flat head wood screws	

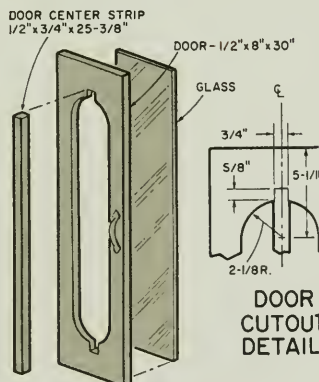
NOTE: Also need 4d and 6d finishing nails, small brads, white glue, 1/4" scrap plywood, 3/4" scrap pine, contact cement, sliding door track and doors, casters, hinges, drawer/door pulls, magnetic catches, ornamental trim, decorative molding and finish coating.



It may be necessary to add plywood caster mountings to provide this 1/4-inch clearance. Fasten the decorative molding strips in place with glue and small brads, and cover all exposed plywood edges with wood tape. Do not cover the edges of the top panels that are flush with the side panels.

Sliding doors for the bookcases will depend on the make and type of track available. The track shown on the plans is of hardwood, and is designed for a lightweight, 1/4-inch thick door. Your lumber

◀ Left: The front panel or drawer can also be made from a 1/4-inch panel glued and nailed to a 1/2-inch panel. Below: Center strips must be flush with two 1/2-inch plywood door panels. ▼



DOOR ASSEMBLY (2)

and hardware dealers should be able to provide you information on the material to use with the track that is available. In any case, each door must be $14\frac{3}{4}$ inches wide.

The bookcases and the corner desk top are held together by a system of "keys" and "ways." Make them up as shown on the plans, using a hard lumber such as solid birch, oak, or maple. Attach one key to each bookcase at the end where the top panel is flush with the side piece.

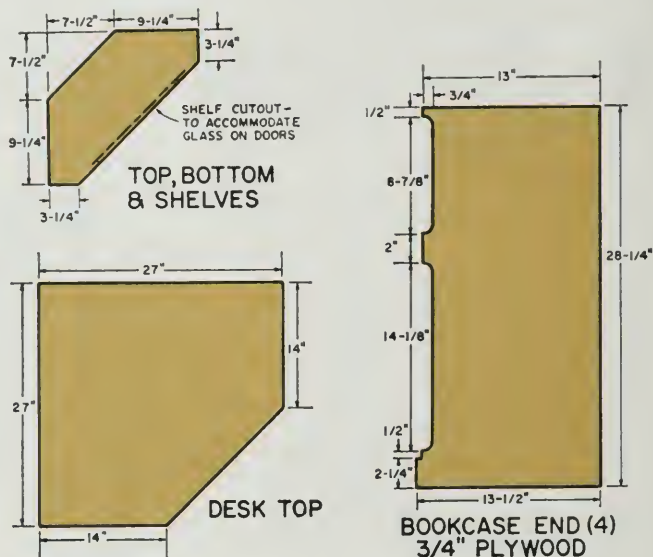
Now make up the desk top itself. Cut out the top panel, and fasten the two way assemblies to it with $\#8$ $1\frac{3}{4}$ -inch flat head wood screws. Note on the plans how the pilot holes are drilled at an angle for these screws. Install the two desk top supports, and the back stop, using glue on mating surfaces. Fasten the supports with 6d finishing nails driven through from the top, and the back stop with small brads driven through from the bottom. Make up the two drawer guides and install them.

The drawer itself is the final unit. The front panel can be made up of $\frac{3}{4}$ -inch plywood, with edges mortised as shown, or from a $\frac{1}{4}$ -inch panel glued and nailed to a $\frac{1}{2}$ -inch panel. Assemble the front panel to the sides and the sides to the back, using glue and 4d finishing nails. Use $\frac{1}{8}$ -inch plywood or tempered hardboard for the bottom, and fasten with glue and small brads. Finally, attach the drawer slides to the top edges of the side panels with glue and brads.

Give each unit at least two coats of the finish of your choice, sanding lightly between each coat. When the final coat is dry, attach all hinges and other hardware. Mount the cabinet unit on the wall. Slide the keys of the bookcases into the ways on the desk top, and slide the drawer into place. Now you can roll the entire unit on its casters into position under the cabinet.

Original design by Steve Ellington.

See also: FURNITURE, INDOOR; WOODWORKING.



➤ Left: View of top, bottom and shelves, desk top. Number of shelves are optional. Right: Make up bookcase ends from $\frac{3}{4}$ -inch plywood.

